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SAMPLE ANALYSIS PLAN
FIELD SAMPLING PLAN

VOLUME I OF II

3748

REMEDIAL INVESTIGATION (RI)/FEASIBILITY STUDY (FS)

McINTOSH PLANT SITE
OLIN CORPORATION
McINTOSH, ALABAMA

for:

Olin Corporation
Charleston, Tennessee

May 1991

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1.0
INTRODUCTION

Olin Chemicals (Olin) operates a diaphragm cell chlor-alkali facility in McIntosh, Alabama for the production of chlorine, caustic, sodium hypochlorite and caustic plant (CP) salt. Rocket fuels are also formulated in an onsite blending facility. In 1980, the plant came under the Resource Conservation and Recovery Act (RCRA) regulations and a number of environmental compliance and remediation activities have been initiated. In 1984, the site was placed on the National Priority List (NPL) by the Environmental Protection Agency (EPA). From 1984 through 1985, ten RCRA Solid Waste Management Units (SWMUs) were closed or clean-closed. In 1987, a RCRA Correction Action Program (CAP) was initiated at the site. In November, 1989, a Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Remedial Investigation (RI)/Risk Assessment (RA) report was submitted to EPA (ERM, 1989). Subsequently, a CERCLA Special Notice letter was issued to Olin on January 15, 1990, inviting Olin to develop a Remedial Investigation and Feasibility Study (RI/FS) scope of work for the McIntosh facility.

An Administrative Order of Consent (Consent Order) became effective May 9, 1990 for the performance of RI/FS at the McIntosh site. This Field Sampling Plan (FSP) has been developed in partial fulfillment of the work items to be performed under the jurisdiction of the Consent Order and is considered to be part of the Sampling and Analysis Plan (SAP Volume I of II).

The objective of the FSP is to provide the methodology and frequency of sampling activities associated with RI/FS activities. This FSP has been developed in accordance with the Office of Solid Waste and Emergency Response (OSWER) Directive 9355.3-01, "Guidance for Conducting Remedial Investigation and Feasibility Studies Under CERCLA, Interim Final," October, 1988, "A Compendium of Superfund Field Operation Methods, OSWER Directive 9355.0-14," December, 1987, and the EPA Region IV Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual (U. S. EPA Region IV Environmental Services Division, April 1, 1986).

As Volume I of II of the SAP, this plan is to be utilized in conjunction with the Quality Assurance Project Plan (QAPP Volume II of II), the RI/FS Work Plan, and the Health and Safety Plan (HSP), as required by the Consent Order. The data gathering activities of the project consist of sampling groundwater, surface water and sediment to determine the nature and extent of contamination. A vegetative stress survey, macroinvertebrate survey and fish sampling will also be conducted to assess potential ecological impacts. This information will be used to evaluate remedial alternatives and perform a Baseline Risk Assessment for the site.

2.0
SITE BACKGROUND AND SETTING

The information on the site background and setting presented in this section has been obtained from the ERM Remedial Investigation/Risk Assessment (RI/RA) report (ERM, 1989).

The Olin plant is located approximately one mile east-southeast of the town of McIntosh, in Washington County, Alabama (Figure 1). The property is bounded on the east by the Tombigbee River, on the west by land west of U. S. Highway 43, on the north by the Ciba-Geigy Corporation plant site and on the south by River Road.

The regional setting for the site is the East Gulf Coastal Plain Physiographic Province. Specifically, the 1500 acres that comprise the Olin property are within the Southern Pine Hills District.

2.1 SITE DESCRIPTION

The Olin McIntosh plant is an active chemical production facility. The main plant and associated Olin properties cover approximately 1,500 acres, with active plant production areas occupying approximately 60 acres. Current active facilities at the plant include: a diaphragm cell chlorine and caustic production process area; a caustic concentration process area; a caustic plant salt process area; a hydrazine blending process area, shipping and transport facilities; process water storage, transport and treatment facilities; and support and office areas. Beyond the active production facilities, the Olin property is heavily forested. The basin area is located on the Olin property, adjacent to the Tombigbee River and east of the active plant facilities.

Two operable units (OU-1 and OU-2) have been designated for the facility. Figure 2 is a facility layout map of the Olin McIntosh plant, which shows the boundaries of the two operable units.

2.1.1 Operable Unit 1

Operable Unit 1 is all Olin property excluding the area designated as Operable Unit 2. Within OU-1 are the following closed, inactive and active Solid Waste Management Units (SWMUs):

1. Stormwater pond (clean-closed)
2. Brine filter backwash pond (clean-closed)
3. Pollution abatement (pH) pond (clean-closed)
4. Weak brine pond (closed)
5. Mercury waste pile storage pad (clean-closed)
6. TCAN hydrolyzer (clean-closed)
7. Mercury drum storage pad (clean-closed)
8. Chromium drum storage pad (clean-closed)
9. PCB/Hexachlorobenzene storage building (clean-closed)
10. Hazardous waste drum (flammable) storage pad (clean-closed)
11. Sanitary landfills (2) (closed)
12. Old plant (CPC) landfill (closed)
13. Ash ponds (2) (inactive)
14. Ash pond (1) (active)
15. Lime ponds (2) (closed)
16. Diaphragm cell brine pond and overflow basin (active)
17. Hexachlorobenzene spoil area (removed)

2.1.2 Operable Unit 2

Operable Unit 2 consists of the basin (65-acre lake), the wetlands within the Olin property line and the wastewater ditch leading to the basin. The basin received wastewater from the Olin facility from 1952 to 1974. During the seasonal high water levels (approximately 4 to 6 months per year), the basin is inundated by, and thus becomes contiguous with the adjacent Tombigbee River.

2.2 SITE CONDITIONS

Most of the information provided here on the general site conditions of the McIntosh plant is extracted from the 1989 RI/RA report (ERM, 1989).

2.2.1 Climatological Information

The following information is based on data from the climatological station in Mobile (approximately 50 miles south of McIntosh).

The McIntosh plant site is typically humid year-round with a subtropical climate. The average annual temperature is about 68°F, with July having the highest average temperature of 82°F and January having the lowest average temperature of 50°F.

South Alabama's annual rainfall is among the highest in the United States, averaging about 64 inches. The precipitation is relatively evenly distributed over the year, although there is a small peak in July during the thunderstorm season, when monthly rainfall averages 7.6 inches. The driest season runs from October through November, when the monthly average is 3.5 inches. Thunderstorms, the predominant mode of precipitation, occur on an average of 80 days a year, more frequently in summer than other seasons.

Wind flow patterns are variable throughout the year, but there are some broad seasonal patterns. From September through February, winds are dominantly in a northerly direction, with dominant southerly and southeasterly winds the remainder of the year.

2.2.2 Topography

The active production areas of the plant are relatively flat with little topographic variation (Figure 1). The elevation varies from about 40 feet (MSL) to less than 20 feet (MSL) in a drainage ditch on the east side of the plant. Elevations elsewhere on the property (outside of the main plant area) range from approximately sea level in the basin to greater than 40 feet (MSL) in the northwest corner of the property. The most distinctive topographic feature is the steep bluff located approximately 4,000 feet east of the main plant area. This bluff defines the edge of the low-lying basin area, which is about 20 feet lower in elevation than the property to the west.

Surface drainage from the main plant production areas is directed through a series of concrete-lined channels to an NPDES-permitted discharge. Beyond the main plant area, natural drainage flows westward to Bilbo Creek and eastward to the Tombigbee River, the primary surface water body near the site. The basin itself drains to the Tombigbee River. Regional drainage patterns will be investigated and additional, site-specific topographic information will be obtained during the RI/FS.

2.2.3 Vegetation

Investigations have been conducted to characterize the vegetation at the Olin site. The following paragraphs, extracted from the ERM RI/RA report (ERM, 1989), summarize the work done in this regard.

The past studies of terrestrial vegetation within a five-mile radius of the Olin site indicated about half of the region's vegetation is bottom-land forest. Mixed hardwood-pine forest accounts for about 30 percent of the area. Wetlands and potential wetlands (bottom-land hardwood) represent 5 percent to 17 percent of the total area. Unique flora and vegetation types include two exceptionally large trees located in a swamp bordering Lewis Creek. These are a bald cypress and a tupelo, each about 90 feet tall. Areas around the Olin basin are populated by cattail marsh and swamp forest.

Wetlands and water-land interfaces at the site include stream banks, lake shores, marshes, swamps, and bogs, the latter of which are covered during part of the year by natural, nonflood waters. The majority of the wetlands identified on and in the vicinity of the site during 1976 were associated with the flood plains of the Tombigbee River and its tributaries. These systems include palustrine-forested wetlands and of palustrine-emergent wetlands. The neighboring upland areas identified in the study are hardwood and pine forests.

2.2.4 Regional Geology

Washington County is located in the Southern Pine Hills District of the East Gulf Coastal Plain Province. The McIntosh area is underlain by alternating beds of unconsolidated-to-consolidated sedimentary rocks that are collectively hundreds of feet thick (Moore, 1971). These rocks dip southwesterly at 30 to 50 feet per mile. The general dip of these rocks is locally interrupted by folds, faults and salt domes. The McIntosh salt dome is the most distinctive structural feature of the area.

Near-surface strata consist of Quaternary alluvial terrace and flood plain sediments deposited by the Tombigbee River. The Quaternary sediments range in thickness from 80 to 100 feet and consist of beds of sand, gravel, silt and clay, which form the Alluvial Aquifer system.

The Alluvial Aquifer is underlain by Miocene sediments. The Miocene Series is composed of alluvial deposits of fine-to-coarse-grained gravel, sand, sandstone and beds of gray-to-varicolored clay. The Miocene Series varies in thickness from less than 275 feet above the McIntosh dome to as much as 600 feet away from the dome.

The sands and gravels of the Miocene Series are an aquifer, which constitutes the most important source of groundwater in the McIntosh area. A Miocene clay strata, which varies in thickness from 80 to 100 feet, lies between the Alluvial Aquifer and the Miocene Aquifer.

2.2.5 Drainage

The majority of surface runoff from the site flows east and southeast to an unnamed tributary, which discharges into the Tombigbee River farther to the southeast. The surface runoff of the western-most portion of the site flows west to Bilbo Creek and ultimately into the Tombigbee River. Drainage from the main plant area is through a system of manmade culverts and ditches, which direct the runoff east and southeast toward the Tombigbee River.

2.2.6 Subsurface Stratigraphy

The near-surface stratigraphy has been defined from soil borings for numerous geotechnical and environmental investigations. Based on descriptions from Soils and Materials Engineers (S&ME 1982) and ERM (1989), the general stratigraphy is as follows:

Unit	Description
Q_1 (Upper Clay Unit)	Red-brown to yellow-brown and gray silty, sandy, plastic clay with discontinuous sand and silt cases. (Q_1 Unit is reportably 1 to 15 feet thick.)
Q_2 (Alluvial Aquifer)	Very fine to fine-grained silty sand in the upper part and fine to coarse-grained sand with varying amounts of gravel in the lower part. Contains thin beds of clay or silty, gravelly clay (Q_2 unit is reportedly 80 to 100 feet thick.)
Tm_1 (Upper Miocene Confining Unit)	Interpreted to be continuous across the site, consisting predominantly of clay with laterally discontinuous sands and silts. (Tm_1 unit is reportedly 80 to 100 feet.)
Tm_2 (Upper Miocene Aquifer)	Primarily thick-bedded, coarse sand and gravel. A clayey unit 10 feet to 30 feet thick occurs within this unit. (Thickness of Tm_2 unit is not well defined and varies with influence of the McIntosh salt dome.)

2.2.7 Hydrogeology

Two aquifers are of concern at the site, the Alluvial Aquifer and the Miocene Aquifer. The Miocene Aquifer is the major groundwater source in the area.

The Alluvial Aquifer is semi-confined and contains discontinuous zones of fine sand, clay and silt; however, these zones do not form a hydrologic boundary. Recharge to the Alluvial Aquifer is from surface infiltration. The aquifer has been contaminated by site constituents and a corrective action program was implemented to remediate this contamination.

The Miocene Aquifer is a confined artesian aquifer, which is not subject to significant leakage from the overlying Alluvial Aquifer. The aquitard between the Alluvial and Miocene Aquifers is the upper Miocene Confining Unit described above. Groundwater contamination has been reported in the Miocene Aquifer at low concentrations during sampling events that were conducted six to nine years ago. The validity of these old data is questionable. Additional sampling is planned during the RI/FS to confirm whether contamination exists in the Miocene Aquifer.

The natural (pre-corrective action) groundwater flow in the Alluvial Aquifer was generally southward from the north property boundary. Due to the topography of the underlying Miocene confining layer and local site recharge areas, the flow divides into western and eastern components. The eastward component discharges to the Tombigbee River. The westward component is influenced by a linear depression in the upper Miocene confining unit. The westward flow is further complicated by a hydraulic mound near the western property boundary, which diverts flow southwardly again. Olin has postulated that this mound is due to the presence of the salt dome. The Alluvial Aquifer ranges in thickness from 80 to 100 feet, with a saturated thickness ranging from 45 to 70 feet. In the vicinity of the site, the average transmissivity is estimated to be 8,500 ft^2/day, and the specific yield is estimated to be 0.20 (S&ME, 1982).

The regional groundwater flow direction in the Miocene Aquifer is generally to the southwest. However, Olin has six active process water wells screened in the Miocene, with a minimum of any two pumping at all times (at approximately 1000 gpm each). Flow is interpreted to be radially toward these pumping wells based on preliminary calculations included in Olin's April 25, 1991 responses to EPA comments on the Work Plan. A more thorough evaluation of groundwater flow and drawdown in the Miocene Aquifer will be conducted during the RI/FS. The average transmissivity of the Miocene Aquifer north of the Olin facility is estimated to be 6,950 ft^2/day (P. E. LaMoreaux 1984).

2.3 REGULATORY BACKGROUND

The Olin McIntosh plant is a diaphragm cell chlor-alkali facility used for production of chlorine, caustic, sodium hypochlorite and caustic plant (CP) salt. In addition, rocket fuels are formulated in an onsite blending facility.

The Olin McIntosh plant currently monitors and reports on several facilities permitted by the EPA and the Alabama Department of Environmental Management (ADEM). These permits include 17 air permits, one NPDES permit with 5 outfalls, one RCRA post-closure permit (including several SWMUs and a groundwater corrective action program), one Class III injection well and one Class V Underground Injection Control (UIC) well.

2.3.1 State and Federal Activities

EPA became involved with the facility in 1976 with the Betz and Converse Environmental Impact study conducted prior to the construction of the chlor-alkali plant. This study was jointly implemented under a third-party agreement among Olin, EPA and the contractors.

The facility came under RCRA in 1980 and Olin implemented a RCRA groundwater monitoring program. Chlorinated organic compounds (including chloroform) and mercury were detected in the Alluvial Aquifer in 1981 and Olin conducted a series of groundwater assessment investigations to determine the nature and extent of contamination.

During 1982, Olin shut down the Crop Protection Chemicals (CPC) and mercury-cell chlorine plants. The CPC plant was dismantled, decommissioned and the site was capped under a plan submitted to and approved by ADEM. The chlorine plant was dismantled and decommissioned between 1982 and 1989.

The Olin McIntosh plant was inspected by an EPA contractor in 1982 and 1983 to calculate a Hazardous Ranking Score (HRS). Despite the strong objections of both Olin and ADEM, the McIntosh plant was placed at position 320 on the National Priority List (NPL). EPA found the following hazardous substances associated with the site:

- Mercury
- Gama-hexachlorocyclohexane
- Hexachlorobenzene
- 1,2,4-trichlorobenzene
- 1,4-dichlorobenzene

From 1984 through 1985, Olin closed or clean-closed ten designated SWMUs. Each closure plan was reviewed and approved by EPA and/or ADEM. Closures were certified at completion and releases from financial responsibility were obtained. In 1987, with EPA/ADEM approval, Olin initiated a RCRA Corrective Action Program (CAP), consisting of five groundwater pumping wells in the Alluvial Aquifer with associated treatment systems. Since implementation of the CAP, groundwater contamination has been observed to decrease at the RCRA compliance boundaries.

In 1986, Camp, Dresser and McKee, Inc. (CDM) conducted a Forward Planning Study and reported that Olin did not comply with the CERCLA policy requirements regarding the protection of wetlands and 40 CFR Part 6 (CDM, 1986). The basin investigation study (Olin, 1988) was implemented in response to the CDM study.

During 1988 Olin closed four of six former mercury cell brine wells under its Underground Injection Control (UIC) permit. The other two mercury cell brine wells, Brine Well No. 1 and Brine Well No. 2, had been previously plugged in 1972 and 1985, respectively. These brine well pluggages were also approved under the UIC permit.

These six wells were all associated with the mercury-cell chlorine plant closed in 1982 and the cavities contain brine with a low concentration of mercury.

In June 1989, EPA and Olin agreed that all data and information developed in the course of Olin's extensive RCRA compliance activities would be collated into a Comprehensive Environmental Response Compensation and Liability Act (CERCLA) Remedial Investigation (RI) Report consistent with the October 1988 U.S. EPA guidelines.

In November 1989, Olin submitted to EPA an RI/RA report for the site (ERM, 1989). On January 15, 1990, Olin received a Special Notice letter from EPA requiring the development of the Scope of Work for a Remedial Investigation/Feasibility Study (RI/FS). In response to the Special Notice letter, the Scope of Work for the RI/FS was developed and submitted to EPA in April 1990. On May 9, 1990, an Administrative Order of Consent (Consent Order) became effective for the performance of the RI/FS at the Olin Chemicals/McIntosh Site in McIntosh, Alabama. The Scope of Work was attached to the Consent Order.

3.0 SAMPLING OBJECTIVES

The primary objectives of the RI/FS are:

- To investigate the nature and lateral and vertical extent of contamination at the site (waste types, concentrations and distributions) for all affected media including air, groundwater, soil, surface water and sediment, including confirmation of the results of previous investigations. The lateral and vertical extent of contamination will include any offsite migration resulting from the entire site.

- To refine and expand the results of the previously submitted Baseline Risk Assessment to assess the current and potential risk to public health, welfare, and the environment.

- To develop and evaluate alternatives for an appropriate remedial action to prevent or mitigate the migration, release or threatened release of contaminants from the site.

This FSP is designed to provide the basis for collecting data to meet these objectives. The data will also be required to meet analytical quality assurance objectives (i.e., suitable for evaluation after data collection). The proposed analytical methods presented in the QAPP have been reviewed to verify that methods will provide detection limits that are adequate for data evaluation and use in risk analysis.

3.1 SPECIFIC DATA QUALITY OBJECTIVES

To satisfy the objectives of the RI/FS, there are several specific data requirements that require field investigation. These are listed below, along with the operable unit that requires the data:

- Groundwater sampling data, (OU-1)
- Domestic well survey and sampling, (OU-1)
- Surface water and sediment sampling data, (OU-2)
- Bathymetric survey data, (OU-2)
- Vegetative stress survey data, (OU-2)
- Macroinvertebrate study data objectives, (OU-2)
- Fish sampling data, (OU-2)

3.1.1 Groundwater Sampling Data Objectives

As stated in Section 2.2.7, two aquifers are of concern at the Olin McIntosh site: the Alluvial Aquifer and the Miocene Aquifer. There is documented contamination in the Alluvial Aquifer. Limited data collected six to nine years ago indicate that the Miocene Aquifer may contain low levels of contamination. Additional data will be collected during the RI/FS to confirm whether contamination exists in the Miocene.

The contaminants of concern detected in the groundwater are mercury, volatile organic compounds, and base/neutral extractable compounds. Chloride is also present and has been used as an indicator of the contaminant plume. The potential sources of these contaminants have been identified from the extensive RCRA monitoring programs (1986 through 1989) at the site. Olin believes that the extent of contamination of the Alluvial Aquifer has been characterized. Additionally, the contaminant plume has been delineated and the surface/subsurface pathways of migration have been identified. Olin has instituted a Corrective Action Program for OU-1 and the program has been in operation since August, 1987.

In order to confirm direction of groundwater flow and groundwater migration pathways, water elevations will be obtained from all 113 monitor wells at the facility. Figure 3 shows the monitor well locations. Data from these wells will be used to generate potentiometric contours.

As part of this RI/FS, selected monitoring, corrective action, and water wells will be sampled and the water will be analyzed for the parameters listed in the QAPP. This will be a one-time sampling event. The information obtained from the sampling event will be used in conjunction with past sampling data to evaluate the nature and extent of groundwater contamination, and resolve any interpretive questions regarding sources and fate. Additionally, the sampling will confirm that the previous data collected under Olin's groundwater detection, assessment and collective action programs are equivalent to current CERCLA standards. Data obtained from one-time sampling will also be used in demonstrating the equivalency of 40 CFR Part 265 closures with 40 CFR Part 264 closure requirements.

In addition, Olin is required to continue quarterly sampling of the RCRA corrective monitor wells under their post-closure permit. The Work Plan shows the locations of these wells.

Sample collection and handling will require strict adherence to EPA approved procedures and close QA/QC surveillance. Sample analysis will be performed by sampling and analytical methods as described in the SAP, which were developed in general accordance with the EPA Engineering Survey Branch Standard Operating Procedures and Quality Assurance Manual (EPA, 1986).

3.1.2 Domestic Well Survey and Sampling Objectives

To adequately characterize the risk associated with OU-1, the domestic wells within a three-mile radius of the site will be identified. Drinking water wells subject to exposure from the site will be sampled and analyzed for site-specific parameters and drinking water quality parameters. Accessibility to these wells for sampling will be dependent on the well owners permission. These data will be required during subsequent assessment of exposure of potential receptors to site contaminants.

3.1.3 Bathymetric Survey Data Objectives

A bathymetric survey will be conducted of the basin. This survey will consists of a series of measurements for water depth, and will be used to characterize the bottom configuration of the basin. The bathymetric survey will assist in determining sample locations along sampling transects and in making subsequent interpretations regarding the depositional history of the basin. The information obtained will be integrated with aerial photographs and topographic maps to produce an interpretive map showing the basin morphology and any identified depositional features (e.g., abandoned stream channels).

3.1.4 Sediment Sampling Data Objectives

A review of previous investigations as summarized in the ERM RI/RA report (ERM, 1989) has shown that available data are insufficient to fully characterize OU-2. Therefore, sediment sampling will be conducted to define lateral and vertical extent of sediment contamination in the basin, the adjacent wetlands and the associated ditches. The basin area and the associated ditches will be investigated first along with the potential pathways outside the boundaries of OU-2. If the extent of contamination has not been determined by investigating the basin area, the investigation will be extended in the direction(s) in which additional data are required.

Sediment samples will consist of both core samples and surface sediments. Core samples will be obtained at selected locations within the basin. The objective of the core sampling is to evaluate the occurrence of contamination with depth, and define the vertical extent of contamination. Grab samples will be collected from the basin, the wastewater ditch, the discharge ditch, the former flow path from the wastewater ditch to the basin and the current path from the wastewater ditch to the discharge ditch. These samples will be obtained at locations based on an established grid to define the lateral extent of contamination and provide detailed sediment description throughout OU-2 on which to base macroinvertebrate sampling locations. Other areas may also be sampled based on a review of the topographic maps and aerial photographs. The bathymetric survey may also indicate additional areas for sampling (localized high or low areas not intercepted by the grid).

3.1.5 Surface Water Sampling Data Objectives

Surface water samples will be collected from the water bodies in OU-2. Surface water samples will be obtained from randomly selected locations in the basin, and from each of the associated ditches that contain water. When there is a sufficient water depth the samples will be obtained from discrete intervals. The surface water sample results will provide data on the lateral and vertical distribution of contaminants in the basin water and water in the associated drainageways. The data will also be used to evaluate the potential impact to human and biota receptors from exposure to basin water.

3.1.6 Macroinvertebrate Study Data Objectives

The composition and diversity of macroinvertebrate communities in contaminated areas (as indicated by sediment sampling) will be compared with those of communities in control areas. Control areas will be determined after initial characterization of the basin. The sampling will provide for a detailed characterization of aquatic macroinvertebrate communities of the basin under nonflood conditions. The basic information on identities and numbers of benthic macroinvertebrates observed or collected per unit of effort will be reported as well as resulting indices calculated for use in comparisons. This survey will provide information regarding potential pathways to human and biota receptors and provide data for the subsequent evaluation of potential remedial alternatives.

3.1.7 Vegetative Stress Survey Data Objectives

As a part of the effort to assess the effects of local contamination in the basin on the biota, a vegetative stress survey will be conducted. This survey will focus on the vegetative cover and wetlands in the vicinity of OU-2.

Since a current biological inventory of the basin and connecting water bodies and/or wetlands is unavailable, the vegetative stress survey will consist of the following tasks:

- Characterization of the principal macrophytic plant communities.

- Survey of indications of stress, if any, to vegetation with particular reference to the distribution of contaminants in surface water and sediments.

The vegetation study phase will consist of a botanist identifying and mapping the principal plant communities in OU-2 based on a review of aerial photographs and a field survey. The data obtained from this review will aid in providing qualitative and quantitative descriptions of the plant communities. A species inventory for the study area will be prepared, with an identification of any endangered plant species.

Upon completion of the vegetation study, a survey will be conducted to identify aberrations in vegetative cover in the study area. Any abnormal variations in tree populations, species, physical characteristics, etc., will be documented as possible evidence of stress. To the degree possible, identification of the extent to which these effects have resulted specifically from the presence of contaminants, as opposed to other associated effects, such as habitat disruption, will also be identified.

3.1.8 Fish Sampling Data Objectives

The 1987 fish sampling program was limited in scope and therefore no conclusions were made regarding the effects of basin contamination on fish species. Any fish sampling program must be designed to account for the fact that the basin is contiguous with the Tombigbee River five to six months a year. Therefore, any fish sampling program will be oriented toward fishes indigenous to the basin and will minimize the effects of fish migration between the basin and the Tombigbee River.

Selection of fishes for any sampling program will be based on the following specific criteria:

- Sampled fishes will be predacious sport fishes and bottom-feeding, bottom-dwelling species. In essence, both types of fishes should represent "worst case" scenarios. Predacious sport fishes represent the upper trophic levels or the top of the food chain and as such should exhibit any tendency to bioaccumulate or biomagnify any contaminants in the system. The bottom-feeding, bottom-dwelling species represent fishes whose life histories, behaviors, and food habits place them in closest physical contact with bottom sediments.

- Both human health and ecological considerations will be taken into account when selecting the fish species for sampling.

- Sampled fishes will represent species most likely to be indigenous to the basin. Thus the focus of sampling will be on, lacustrine (lake-dwelling) fish species and particularly those inclined toward minimal migratory movements. Lotic or riverine (river-dwelling) species will be avoided whenever possible. In spite of such precautions, it is recognized that fish captured in the basin may have spent at least part of their lives in the river environment. That factor must be considered when interpreting the analytical results.

The aforementioned criteria will focus sampling on target species in order to yield optimal and valuable information. The planned restriction of tissue sampling to fishes likely to represent "worst-case" concentrations will provide a basis for describing or estimating the extent of contamination. In light of the desire for expeditious completion of the RI/FS, it is reasonable to limit the scope to characterizing the extremes and then estimating the potential levels in other components of the food web. This estimate will be a qualitative narrative of the presence and movement of the contaminants in the aquatic food web.

To minimize, as much as possible, the complicating factor of migration, Olin plans to sample fish that are less likely to engage in large-scale movements. Accordingly, largemouth bass (Micropterus salmoides) and either yellow or black bullhead (Ictalurus natalis or I. melas) are designated as the preferred species to sample, if available in sufficient quantity. The former is a predacious species which tends to be relatively sedentary (particularly the older, larger individuals). Largemouth bass represent the top of the aquatic "food chain," and provide the additional advantage of being a favored sportfish. Use of this species will thus provide a good basis for estimation of both ecological and human risk. The bullheads are bottom-dwelling, bottom-feeding omnivores which will provide an excellent indication of the significance of intimate contact (through food ingestion and gill ventilation) with the sediments. Bullheads are believed to be less migratory than other Ictalurus, such as the channel catfish. Although occasionally eaten by humans, bullheads provide a particular advantage from the ecological risk perspective because they are common prey of piscivorous reptiles, birds, and mammals. In the event that reasonable sampling efforts fail to yield the specified minimum number of individuals for each species (20), alternative species will be selected on the basis of the same criteria noted above. Possible acceptable alternatives to largemouth bass are envisioned as warmouth (Lepomis gulosus) or black crappie (Pomoxis nigromaculatus).

Olin also proposes to address additional considerations as part of any fish sampling program. Those considerations are as follows:

- Sampling will be conducted on free-swimming, feral fishes from throughout the basin.

- Filets will be analyzed separately from each individual fish for total mercury and selected organic compounds. Further analyses will be performed on the five samples described below to provide whole-body concentrations. The filets represent the portion of the fish most likely to be consumed by humans. The whole body analyses will provide insight into potential ingestion-pathway exposures to wildlife.

- Adequate statistical design and sufficient sample sizes are critical to generating valid, interpretable data. A sample size of a minimum of twenty individuals of each selected fish species was selected based on the characterization of the variability in fish, professional judgement, and experience. Five of the 20 individuals of each species will be analyzed further to provide "whole body" results.

Sampling of feral fishes has the advantage (over cage studies) of representing the "real world" situation by utilizing free-ranging specimens. However, this approach has the disadvantage that some captured specimens may have spent portions of their lives in the Tombigbee River and thus would not completely represent conditions in the basin.

Electrofishing, hoop netting, and other gear appropriate to desired species would be employed to capture fishes. A preliminary electrofishing survey will be conducted in conjunction with the Phase I bathymetric studies to verify the availability of the preferred species for sampling. Detailed fish sampling methodologies and protocols will be submitted to EPA in a revised SAP.

3.1.9 Additional Objectives

Data obtained from each aspect of operations will be evaluated to determine the need for additional detailed investigation. If additional data are needed, additional activities will be implemented. Any additional work may require modifications/addenda to the various project plans (Work Plan, SAP, HSP, etc.). These modifications will be incorporated as approved by EPA.

3.2 FIELD ACTIVITIES

Olin will initiate field support activities following approval of the Work Plan and Sampling and Analysis Plan (SAP). Olin will notify EPA at least two weeks prior to initiating any field support activities so that EPA may adequately schedule oversight tasks. Further, Olin will notify EPA at least two weeks in advance of the field work regarding the planned dates for field activities in both of the aforementioned operable units. Olin will also notify EPA in writing upon completion of field support activities.

The field activities proposed for OU-1 include the following:

- A one-time sampling of selected monitoring, corrective action and water wells.

- If any drinking water wells are located within a three-mile radius of the site, sampling of these wells.

The field activities proposed for OU-2 include the following:

- Bathymetric survey of the basin to map the bottom configuration.
- Sampling and analysis of basin sediments to determine the lateral and vertical extent of contamination by sampling on a grid and at incremental depths at selected locations.
- Sampling of sediments and surface water from the wastewater ditch and the drainages from the wastewater ditch to the basin.
- Sampling of surface waters and sediments along the pathway where the basin discharges into the Tombigbee River.
- A vegetative stress survey to assess potential ecological impacts.
- Based upon the sediment sampling, a study of macroinvertebrates will be undertaken in the basin to assess potential impacts on these organisms. Any impacts will be evaluated by comparing diversity indices and species composition in contaminated areas to those in control areas.
- Fish sampling and analysis of selected species in the basin.

These activities are described in more detail in the following sections. Table 1 summarizes the field activities. Some of the details not presented (e.g., macroinvertebrate sampling locations, specifics of the fish sampling plan) will be determined after reviewing the data from the sediment and surface water sampling, and will be presented in a revised SAP.

3.2.1 Operable Unit 1 Sampling Activities

The field investigations for OU-1 will consist of the following:

- Groundwater Sampling: Thirty-two wells are schedule to be sampled. These include monitor wells, corrective action wells and process water wells. Well locations are discussed in Section 4.1.1. In addition, potentiometric data will be collected from all monitor wells at the facility.

The potentiometric data will be used to confirm the upgradient well locations prior to sampling. The sampled wells will be analyzed for the following constituents as specified in the EPA Contract Laboratory Program (CLP): Mercury (total and dissolved), a list of thirteen other Target Analyte constituents (in addition to mercury) that are also included on the priority pollutant list (each of these for total and dissolved concentrations), Target Compound List (TCL), Volatile Organics, TCL Semi-Volatile Organics, TCL Pesticide/PCBs, and Chloride. The analytical protocols will be in accordance with the QAPP, as approved by EPA.

- Domestic Well Survey and Sampling. In addition to the sampling of onsite wells, residential drinking water wells, within a three-mile radius, and potentially subject to exposure from the site will also be sampled. Initially, a survey will be conducted to identify all domestic water wells within the target radius. Previous surveys (BCM, 1987) have identified a total of 35 domestic wells in the three-mile radius. The approximate location of each identified well will be displayed on a map. The study has stated that not all of these wells are being used for drinking water purposes. The proposed survey will consist of a review of records, a mail-out of questionnaires, and a phone survey. A door-to-door survey will be conducted of the residences that are not reached by mail or telephone. After the survey, the identified drinking water wells will be sampled for total mercury, selected organic parameters based on sampling of on-site monitor wells, Total Organic Carbon (TOC), Total Dissolved Solids (TDS), Total Suspended Solids (TSS), and Chloride. Accessibility to these wells for sampling will be dependent on the well owners' permission.

3.2.2 Operable Unit 2 Sampling Activities

For OU-2, the field investigations will consist of the following:

- Phase I: Bathymetric Survey
- Phase I: Sediment Sampling
- Phase I: Surface Water Sampling
- Phase II: Vegetative Stress Survey
- Phase II: Macroinvertebrate Study
- Phase II: Fish Sampling
- Phase II: Sediment Sampling

These activities are described in more detail below.

3.2.2.1 Phase I: Bathymetric Survey

A bathymetric survey of the basin bottom will be conducted during Phase I. This survey will consist of developing transects in both the north-south and east-west directions and determining water depths at specified intervals along these transects. The aim of this survey will be to define the bottom configuration of the basin, and in conjunction with other data, develop interpretations on the basin depositional history.

3.2.2.2 Phase I: Sediment Sampling.

Core sediment samples will be collected during Phase I at locations based on the 1987 basin investigation (Olin, 1988). Core depths and sample intervals will be based on field conditions (e.g., thickness of sediment, percent recovery in core, etc.). In addition to the core sampling, grab surface samples will be collected on an established grid across the basin, the wastewater ditch, discharge ditch, the former flow path from the wastewater ditch to the basin and the current flow path from the wastewater ditch to the discharge ditch. Additional samples may also be collected based on topographic features of the basin bottom defined by the bathymetric survey (e.g., localized high or low areas), and depositional history interpretations from the evaluation of topographic maps and aerial photographs. All samples will be split and analyzed for total mercury.

In addition to the total mercury analysis, selected split core samples and split grid samples will be analyzed for soluble mercury, pH, Total Organic Carbon (TOC), sulfide/sulfate, the selected list of TAL constituents, TCL Volatile Organics, TCL Semi-Volatile Organics, and Pesticides/PCBs. The remaining sample fractions will be refrigerated and protected from light until the above analyses are completed. The results of the CLP (DQO Level IV) analyses will be used to identify appropriate indicator contaminant(s) to define the organic contamination in the basin. The refrigerated grid samples and core samples will then be analyzed for the selected organic indicator contaminant(s). Olin proposes to develop an appropriate laboratory analytical technique (DQO Level II) to screen for the indicator contaminant(s) that are identified, which may be a field laboratory technique. This technique will be verified by comparing the screening results to replicate samples of the grid samples and the cores that were analyzed by CLP protocols.

This plan requires holding the samples refrigerated and protected from light for a maximum of 60 days. All Volatile Organic Analysis (VOA) will be completed within the CLP holding times using CLP procedures. The existing data and knowledge of the site and past chemical data from basin sediments indicates that the probable organics to be used for indicator parameter(s) in the sediments are generally stable and not sensitive to holding times (e.g., chlorinated benzenes). In any event, Olin does not propose the holding times will not exceed a holding time of 60 days for any of the samples.

3.2.2.3 Phase I: Surface Water Sampling

Surface water samples will be collected at randomly selected grid locations in the basin. Surface water samples will also be obtained from the associated drainages that contain water. If the water depth is greater than 3 feet at the selected sample location, the water samples will be obtained from discrete intervals in the water column (a maximum of three samples per location). The water samples will be analyzed for mercury (total and dissolved) the selected list of other TAL constituents (total and dissolved), TCL Volatile Organics, TCL Semi-Volatile Organics, TCL Pesticides/PCBs, Dissolved Oxygen (DO), pH, TOC, Total Suspended Solids (TSS), and Total Dissolved Solids (TDS).

3.2.2.4 Phase II: Vegetative Stress Survey

The field activities will consist of a botanist identifying and mapping the principal plant communities in OU-2 based on a survey and a review of aerial photographs. The data obtained from this review will aid in providing qualitative and quantitative descriptions of the plant communities. A species inventory for the study area will be prepared, with an identification of any endangered plant species. A survey will then be conducted to identify aberrations in vegetative cover in the study area. Any abnormal variations will be documented as possible evidence of stress.

The survey will include evaluation of the influence of localized topographic features (e.g., ditches, levees, meander scars, etc.) on vegetative community structure. This consideration will assist in interpreting apparent indications of stress, by accounting for differences attributable to elevation or slope versus those which may be related to contaminants. The indicators could be browning of a patch of grass, trees with dry leaves and drooping branches, etc. Such areas will be identified and marked on maps for further investigation.

3.2.2.5 Phase II: Macroinvertebrate Study

Based on the results of sediment and water sampling, a study of aquatic macroinvertebrates in the basin and associated ditches will be undertaken to assess potential biological impacts. The basic information on identities and numbers of benthic macroinvertebrates observed or collected per unit of effort will be reported as well as the resulting indices calculated for use in comparisons. The impacts will be determined by comparing diversity indices and species composition of contaminated areas with those in control areas.

3.2.2.6 Phase II: Fish Sampling

Tissues from fish species representing both the top of the aquatic food chain as well as the bottom-dwelling, bottom-feeding existence will be sampled and analyzed for mercury and selected organic contaminants. The fishes selected will include those likely to be consumed by humans and wildlife. Within these constraints, species that are most likely to be indigenous to the basin (i.e., least migratory) will be chosen. Accordingly, largemouth bass and either yellow or black bullheads will be sampled if available in sufficient numbers. In addition to the sampled fishes, the identities and catches/effort of fish taken during sampling for tissue will be recorded to provide information on the basin fish communities under nonflood conditions.

3.2.2.7 Phase II: Sediment Sampling

Phase II sediment sampling will be conducted after receipt of the chemical analyses from Phase I activities. Phase II will consist of collecting additional cores in the basin and/or drainageways at potential "hot spot" locations. The locations and vertical intervals of the cores will be based on the Phase I results. The Phase II cores will be used to identify the vertical extent of contamination in the areas with greatest contamination in the surficial soil. Discrete depth analysis will also be conducted from selected sediment cores to evaluate the bioaccessible zone (upper 6 inches). The Phase II sediments will be analyzed for mercury and the organic indicator parameter(s). The concentrations of the organic indicator parameter(s) will be determined using an analytical technique that has detection limits equivalent to CLP.

4.0
SAMPLE LOCATION AND FREQUENCY

The sampling activities are described in Section 3.2 of this FSP. The sampling locations associated with each phase of the RI/FS are presented in the following paragraphs. The anticipated number of samples to be collected for analysis per media is summarized in Table 2.

4.1 OPERABLE UNIT 1

4.1.1 Groundwater Sampling

Water elevations will be obtained from all 113 monitor wells that are shown on Figure 3.

As agreed to in the Scope of Work, a one-time sampling of Alluvial Aquifer monitoring wells, Alluvial Aquifer corrective action wells and Miocene Aquifer monitor wells, and Miocene Aquifer process water supply wells will be conducted to verify findings from previous investigations in terms of nature and extent of contamination. Figure 4 shows the wells to be sampled, which include:

- BR8, MP13, BR7 and BR7D (BR8 is to verify mercury, chloride and total organic compounds across the apparent hydraulic divide and MP13, BR7 and BR7D are to monitor downgradient beneath the Brine Pond).
- E4, E5, MP14 and MP15 (to verify mercury and chloride plumes downgradient from Old CPC Landfill).
- WP6 (approximately 2,300 feet west of CPC Landfill).
- E2 and E1 (southeasterly migration of mercury plume as previously identified).
- PL10S and PL10D (eastward migration of plume).
- PL4S and PL4D (westward migration of plume).
- PL9D and PL9S (southeastward migration of plume).

- PL8S and PL8D (eastward migration of total organic compounds).
- SL2, SL3 and SL4 (the sanitary landfill area).
- CA1 through CA5 (corrective action wells).
- DH1, DH3, WW8, and WW12 (Miocene Aquifer wells).
- WP9A and PE3D (upgradient wells for background sampling).

In addition to the one-time sampling event, Olin will continue to sample the RCRA corrective action monitor wells on a quarterly basis. The locations of the RCRA corrective action wells are presented in the Work Plan.

4.1.2 Domestic Well Survey and Sampling

Domestic water wells within a three-mile radius of the site will be surveyed. A one-time sampling is proposed for all drinking water wells potentially subject to exposure from the site that are identified. The locations and status of these wells will be determined from the results of the survey. Accessibility to these wells will be dependent on the well owner's permission.

4.2. OPERABLE UNIT TWO

4.2.1 Bathymetric Surveys

A bathymetric survey of the basin will be conducted along a series of transects in both north-south and east-west directions. The locations and numbers of the transects will be based on accessibility and field conditions.

4.2.2 Sediment Sampling

The core and grab sediment sampling locations for Phase I are shown in Figure 5. Cores will be collected from three locations where samples were collected during the 1987 basin investigation (Olin, 1988) (the two locations with the highest mercury concentrations, and the one location with the highest hexachlorobenzene concentration). Sediment samples will be collected and retained at incremental depths from the cores.

Core depths and sample intervals will be based on field conditions (e.g., thickness of sediment, percent recovery in core, etc.). However, it is anticipated that a 6-inch sampling interval will be used.

Surficial grab samples (upper six inches of sediment) will be collected along the basin wastewater ditch, discharge ditch, the former flow path from the wastewater ditch to the basin and the current flow path from the wastewater ditches to the discharge ditch. A surveyed grid will be established on an approximate 200-foot spacing across the basin, and the basin grab samples will be collected at the intersection of the grid lines (an estimated 77 samples). Surface sediment samples will be collected approximately every 200 feet along the center-lines of the sampled ditches (an estimated 32 samples). One sample will be obtained at the approximate intersection of the discharge ditch and Olin's property boundary. Its exact location will be determined in the field with EPA's concurrence. Figure 5 shows the proposed sample locations for a typical 200-foot spacing grid. The background sediment sample will be obtained upstream at a location to be field determined (with EPA concurrence). Additional grab samples may also be collected based on topographic features of the basin bottom defined in the bathymetric survey (e.g., localized high or low areas not intersected by the grid sample points). The depositional interpretations will also be considered in selecting additional sample locations.

All the Phase I sediment samples will be split into two fractions, "subsamples." One subsample from each location will be analyzed for total mercury. In addition to the total mercury analysis, core subsamples from each 1-foot interval and 20 percent of the grid samples will be analyzed for soluble mercury, TOC, sulfide/sulfate, the selected list of TAL constituents, TCL Volatile Organics, TCL Semi-Volatile Organics, and Pesticides/PCBs. The remaining subsample from each location will be refrigerated and protected from light until the above analyses are completed. Figure 5 indicates the grid locations planned for the CLP analyses (DQO Level IV). These locations were selected using a random number table. The results of the CLP analyses will be used to identify appropriate indicator contaminant(s) to define the organic contamination in the basin. The refrigerated grid subsamples and remaining core subsamples (the six-inch intervals that were not analyzed by CLP) will then be analyzed for the selected organic indicator contaminant(s) using a laboratory screening technique (DQO Level II).

The Phase II sample locations and depths will be dependent on the Phase I results. Up to five cores will be completed at "hot spot" locations. The upper 6 inches of these cores will be analyzed at 2-inch increments to evaluate the bioaccessible zone. The Phase II samples will be analyzed for mercury and the organic indicator parameter(s).

4.2.3 Surface Water Sampling

Surface water samples will be collected at five randomly selected grid locations in the basin and from each of the associated drainages of the basin that contain water. In addition, a sample will be taken at the outfall of the wastewater ditch. If the water depth is greater than 3 feet at the selected sample location, the water samples will be collected from discrete intervals in the water column (a maximum of three samples per location).

4.2.4 Vegetative Stress Survey

The vegetation survey will be conducted in the basin and surrounding wetlands.

4.2.5 Macroinvertebrate Study

Based on the results of sediment and surface water analyses, stations will be established for the sampling of aquatic macroinvertebrates from physically-comparable substrates in contaminated and uncontaminated portions of the basin. At a minimum, it is anticipated that indicator and control areas will be selected for replicate (3 replicate grabs) sampling of each of two habitats: (a) open bottom; and (b) shorelines. Additional criteria for determining frequency and sample locations include sediment type, depth of water, and the distribution of contaminants. Given these criteria, the macroinvertebrate sample locations will be selected to assess (if possible) effects due to contamination rather than other factors such as sediment type. Each grab sample will be processed individually to develop basic information on identities and numbers of individuals per unit of effort. Details will be presented in the revised SAP based on results of Phase I.

4.2.6 Fish Sampling

Twenty specimens of each of two species of fish will be collected from the basin. Five samples from each fish species will be analyzed for whole body analysis. In addition to the sampled fishes, the identities and catches/effort of fish taken during sampling for tissue will be recorded to provide information on the basin fish communities under nonflood conditions. Additional fish sampling details will be provided in a revised SAP based on the results of Phase I.

5.0
SAMPLING EQUIPMENT AND PROCEDURES

The procedures and equipment to perform the sampling for RI/FS are presented herein. The details of the macroinvertebrate and fish sampling procedures will be expanded in a revised SAP.

5.1 GROUNDWATER SAMPLING

Selected wells at the site will be sampled to evaluate current groundwater quality as part of the characterization of OU-1. The sampling procedures in this section pertain to sampling monitor wells, corrective action wells, and process water wells. The sampling procedures for identified drinking water wells will be dependent on well characteristics.

5.1.1 Equipment

The equipment to be utilized for groundwater sampling will consist of the following:

- Dedicated or decontaminated stainless steel centrifugal submersible pumps.
- Teflon bladder pumps.
- Dedicated or decontaminated teflon or stainless steel bailer, with bottom check valves.
- Permanently mounted corrective action and process water well pumps.
- Electronic water measuring device
- Container of known volume for measurement of volume of water removed.

Teflon bladder pumps are installed in shallow wells and stainless steel centrifugal pumps are installed in deep wells. The bladder pumps are preferable over centrifugal pumps, but the bladder pumps do not provide the necessary pressures and flow rates in the deeper wells.

The corrective action and onsite process water wells have permanently mounted pumps, that will be used for sampling. The details (construction, specifications, pumping equipment, etc.) of the offsite domestic water wells are not known.

5.1.2 Procedure

The groundwater elevation will be measured from the monitor wells that are sampled in addition to the monitor wells shown on Figure 3 that are not sampled. Each well will have a permanent, easily identified reference point from which its water level measurement is taken. The reference points have been established by a licensed surveyor in relation to the National Geodetic Vertical Datum. An electronic device will be used to measure depth to the surface of the groundwater. This device used to detect the water level surface will be sufficiently sensitive so that reproducible measurements to $\pm$0.01 foot can be obtained. Three replicate measurements will be made.

A survey for non-aqueous phase liquids (NAPL) will be conducted prior to any sampling or purging on the wells. This survey will be conducted on wells to be sampled that have sufficient room to insert a 1.25-inch diameter bailer. Immiscible layers have not been found to be present in any of the monitor wells at the facility. To check for the presence of a separate floating NAPL, a clear acrylic bailer will be lowered into the well to just below the liquid surface and then withdrawn and examined for presence of floating NAPL. The bailer will then be lowered all the way to the bottom of the well, withdrawn and examined to check for presence of a dense NAPL. If NAPL is found, samples at the NAPL will be collected and identified/characterized in an analytical laboratory.

The field measurements for the monitor and corrective action wells designated for sampling will include depth to standing water and total depth of the well to the bottom of the intake screen structure. This information will be used to calculate the volume of stagnant water in the well and provide a check on the integrity of the well (e.g., identify siltation problems).

Should the total depth measurement show that over ten percent of the screen area is blocked, indicating sediment in the bottom of the screen, the well will be redeveloped prior to sampling. This redevelopment will be by overpumping, swabbing, bailing or other appropriate method until the sediment thickness is less than the length of the bottom sump. Well volumes removed during redevelopment will not count toward the three well volumes for purging. Redevelopment tools will be decontaminated between wells.

To reduce the potential for cross-contamination, the non-dedicated equipment (i.e., water level measuring devices, etc.) will be decontaminated between monitor wells. Since the wells are to be purged after using the water level meter, and prior to sampling, the meter probe will be decontaminated by rinsing with deionized water between locations. If NAPL is sampled, the sampling equipment will be disposed and a new bailer will be used for other wells to check for NAPL. If NAPL is not detected, the bailer will be decontaminated in accordance with Section 5.10.

Well Evacuation

The water standing in a well prior to sampling may not be representative of in situ groundwater quality. Therefore, the standing water in the well will be removed prior to sampling so that formation water can replace the stagnant water.

Typically, three to five well volumes will be evacuated from the well using the equipment listed in Section 5.1.1. A well volume is defined as the volume of water in the well between the water surface and the bottom of the well. The well volume is the product of the height of the water column in the well in feet times the number of gallons per foot (e.g., 0.66 gallons per foot for a 4-inch well). The specific conductance, temperature and pH will be recorded, after each well volume, during purging to aid in determining whether the well has been purged sufficiently for sampling.

If a well does not produce three well volumes in 24-hours, that well will be purged to dryness at the end of the 24-hour period and sampled as soon as it has recovered sufficiently.

The purged wells will be sampled immediately after purging if enough water is available. In low-yielding wells, it may be necessary to allow the wells to recovery prior to sampling. These wells will be sampled as soon as sufficient water is available. However, in all cases, the wells will be sampled within 24 hours of purging.

Sample Withdrawal

To verify that the groundwater sample is representative of the formation water, it is important to minimize physically altering or chemically contaminating the sample during the withdrawal process. In order to minimize the possibility of sample contamination, only dedicated or decontaminated sampling equipment will be used.

The following sampling techniques will be observed during the groundwater monitoring well sampling operation:

- The bailer (if used) will be equipped with a bottom filling check valve to minimize agitation or aeration of the sample.
- Sampling pumps will be operated carefully in a continuous manner to minimize aerating of samples.
- Sampling equipment will never be dropped into the well, because this may cause some degassing of the water upon impact.
- The groundwater will be placed directly into the sample container in a way that will minimize agitation and aeration. Sample containers will be filled in such a way to minimize head space.
- Clean sampling equipment will not be placed directly on the ground or any potentially contaminated surface prior to insertion into the well.

Samples will be collected and containerized in order of the parameters' volatilization sensitivity. Sample containers will be labeled as described in Section 5.8. Sample preservation, holding time, and container requirements are listed in Table 3.

The samples will be packed into coolers as they are collected. Shipment will be next-day delivery (except Saturdays). The samples will be shipped no later than one day from the day they are collected (two days if collected on Saturdays or holidays).

Field Analyses

Field tests will be conducted during purging and on groundwater samples from each well. These field tests are pH, conductivity and temperature. Samples will be collected in clean bottles for field analysis. A temperature measurement will be conducted first, as this parameter changes most rapidly, followed by pH and specific conductivity. Field measurements will be recorded in the field log book and on the groundwater sampling report form. A total of four replicates will be measured for each parameter.

5.1.3 Documentation

Groundwater sampling will be documented in the field log book as described in Section 5.9 as well as on a groundwater sampling report form for each well sampled. A copy of the sampling report form is presented as Appendix A. Pertinent information includes evacuation methodology, volumes purged, field measurements and sample identification.

5.2 BATHYMETRIC SURVEY

A bathymetric survey will be conducted by obtaining continuous depth measurements of the basin as a boat is moved along transects. This information is then used to interpret the bottom configuration of the basin.

5.2.1 Equipment

A boat equipped with an outboard motor and a self-recording (stripchart) fathometer will be used. Transects will be surveyed using an electronic distance measuring unit (EDM).

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5.2.2 Procedure

The method requires the use of a small boat equipped with an outboard motor and a self-recording (stripchart) fathometer. First, the transect will be measured by positioning a programmable electronic distance measuring unit (EDM) set up on one side of the basin and sighting across to a prism(s) on the opposite shore. Once this distance is obtained, the initial sample points will be established again using the EDM and sighting to the boat operator, who will transverse the transect line at a constant speed towards a target on shore. Horizontal tracking can be accomplished with the EDM set to continuous tracking mode and sighting to prisms on the boat. Once an appropriate distance has been reached, the information is relayed from shore via a two-way radio to the boat operator, who sets the position in the basin with a float and marks the information on the stripchart, using a toggle switch that drives an electrostatic scriber. When the boat passes a significant morphological feature such as an inferred channel or depression in the basin bottom, the boat operator transmits this information to shore and the distance as read from the EDM is radioed back to the boat operator from shore. The survey will be conducted along both a north-south and east-west transect direction. The data collected at intersections of two transects will be checked against each other as confirmation. These procedures may have to be varied depending on access to the shoreline at the time of the survey.

5.2.3 Documentation

All information pertinent to field observation and transects will be recorded in the field log book described in Section 5.9, in addition to information recorded on the (stripchart) fathometer. Information to be included beyond the general requirements listed in Section 5.9 include:

- Location, orientation, and distance of transects
- Description of significant features of the basin.

5.3 SEDIMENT SAMPLING

Sediment samples will be obtained from the basin, wastewater ditch, discharge ditch, and, post drainageways from the wastewater ditch to the basin.

5.3.1 Equipment

Sediments will be sampled using stainless steel trowels/shovels, grab-type surface sampler and a vibracoring unit. Discrete surface sediment samples will be collected using stainless steel trowels/shovels in areas that are accessible to these hand sampling tools. In areas where there is significant water, such as the basin and some areas of the drainageways, the discrete samples will be collected with grab samplers such as an Ekman, Ponar or Peterson dredge. These samplers are designed to retrieve bulk sediments from a 4- to 6-inch depth, remotely. A vibracoring unit mounted on a barge will be used to collect the core samples.

5.3.2 Procedure

All sample locations will be referenced to a grid based on the plant coordinates. For discrete samples using the shovel/trowel, the sampling area will be first cleared of vegetation and/or debris. The sample will be collected to a depth of 6 inches such that minimal volatilization is allowed and then deposited in a stainless steel bowl. The sample is then transferred to the appropriate container for analysis. The hole will be backfilled with native soils and vegetation.

Sediments that are sampled using grab-type samples will be obtained by lowering the sampler to the sediment surface, and releasing a weight down a messenger line to activate the closure mechanism which excavates the surface sediments. Upon reaching the surface, the sample will be drained of free water and deposited in a stainless steel bowl set within a larger catch basin.

Subsurface cores will be obtained using a vibracorer mounted on a barge. The vibracore method requires the use of thin-walled aluminum irrigation pipe marked in

1-foot intervals for visual reference during the coring. Before using the core pipe, it is decontaminated using the procedures outlined in Section 5.10. The vibracore unit will be driven by a gas-powered motor. A quick-release clamp affixes the vibracore unit to the core pipe which is positioned over the sampling site. As the unit is throttled up, the vibrations are transferred from the head clamp to the core pipe, thus fluidizing the sediments adjacent to the core pipe and allowing it to pass through the sediments with minimal resistance until the desired depth is achieved or refusal occurs. At this time, the vibracore unit is stopped and disconnected. Compaction/displacement are measured, then the core pipe is filled with water and capped to create a vacuum, thus enabling retention of the core when it is being lifted by a battery-operated winch. The water is released when the core is cut to its requisite length. The core is also labeled and marked for orientation. A small boat is used to ferry cores from the barge to a sample handling area which forms a designated exclusion zone consisting of sample preparation, equipment storage, and personnel decontamination.

The vibracore sample will be processed at the exclusion zone. The core will be split using either electronic metal shears or a circular saw equipped with a carbide-tipped blade set for minimum penetration into the core. Two lengthwise cuts will be made along opposite sides of the core pipe to permit splitting of the sample with a wire saw. Care will be taken cutting the aluminum vibracore and collecting the sample from within. Aluminum is an interferant in metals analyses for soils; therefore, cuttings and fragments should be removed before the sample is collected. The core will be opened to yield two relatively undisturbed core halves. The lithology along the core will be described by a geologist and noted on a core description sheet, with attention paid to defining the sediment type, particle size characteristics, color, depths which represent undisturbed, natural lacustrine/riverine composition, disturbed matter resulting from human activity, and natural sedimentation from lake processes.

Oblique photographs of each core will be taken using a hand-held, 35 mm camera equipped with an appropriate filter and slide film. A scale, core number, core orientation, and core length, will be annotated using a broad tip permanent marker on plastic sheeting that underlies the core. This information, including the film exposure number will be entered in the field log book. In the event of having to photograph a lengthy core, an overlap mark will be made on the plastic sheeting to serve as a reference point for the next film exposure.

A sample will be scooped from the interior of the core section and homogenized in a stainless steel bowl. An osmotic knife will be used to facilitate the sampling effort, especially when clays are being sampled. Core samples will be taken at discrete intervals dependent on field activities. It is anticipated that 6-inch intervals will be used. Prior to removing the sample, a thin layer along the surface will be removed and discarded to ensure that the laboratory sample is undisturbed. Each sample interval will consist of the inner portion of the cores. The one-half inch of sediment adjacent to the wall of the core pipe will be excluded from sampling due to the potential for cross contamination occurring when the core pipe is driven into the sediment. Each core sample will represent a homogeneous sediment mixture taken along the length of a sampling interval. Samples will be placed in appropriate sample containers and labeled as described in Section 5.8. Sample preservation, holding time and container requirements are listed on Table 3.

The samples will be packed into coolers as they are collected. The subsamples to be stored will be placed in refrigerators at the end of each sampling day. Samples to be sent to the laboratory will be sent next-day delivery (except Saturdays or holidays). The samples will be shipped no later than one day from the day they are collected (two days for samples collected on Saturdays or holidays).

5.3.3 Documentation

All information pertinent to field observations and sampling will be recorded in a field log book as described in Section 5.9. Detailed lithologic descriptions will be recorded. These descriptions will include, at a minimum, sediment type, particle size characteristics, color, any inclusions (e.g., twigs, rocks, etc.), and other pertinent details. These descriptions will be recorded in the field log books for the surface sediments and core description sheets for the cores. Additional details of core description that will be noted are listed in Section 5.3.2.

5.4 SURFACE WATER SAMPLING

Surface water samples will be collected from randomly selected locations in the basin, and each of the associated ditches that contain water. In addition, a sample will be taken from the outfall discharging to the wastewater ditch.

5.4.1 Equipment

A one-liter capacity LaMotte or Von Dorn-type sampler equipped with a positive messenger-activated closing mechanism will be used.

5.4.2 Procedure

Water samples will be obtained at discrete intervals in the water bodies that contain sufficient water (greater than 3 feet), with a maximum of three samples at any location. Care will be taken not to disturb the bottom sediments during sampling. The sampling devices are equipped with a water sampling cylinder equipped with a positive messenger-activated closing mechanism. After retrieving a sample from each discrete depth, the water will be transferred from the sampler to the appropriate containers supplied by the analytical laboratory. The samples will be collected in the order of volatile sensitivity. Sample preservation, holding time, and container requirements are listed in Table 3. Sample labeling is described in Section 5.8.

The samples will be packed into coolers as they are collected. Shipment will be next-day delivery (except Saturdays or holidays). The samples will be shipped no later than one day from the day they are collected (two days if collected on Saturdays or holidays).

Field Analyses

Field tests will be conducted on the surface water samples. These tests include pH, conductivity, temperature and dissolved oxygen. Samples will be collected in clean bottles for pH conductivity and temperature measurements. A temperature measurement will be conducted first, as this parameter changes most rapidly, followed by pH and specific conductivity. Dissolved oxygen will also be measured by field analysis. Depending on the meter type, the readings will either be obtained directly, by lowering a probe to the depth where the water sample is collected, or the reading will be taken from samples collected in clean sample bottles. Field measurements will be recorded in the field log book. A total of four replicates will be measured for each parameter.

5.4.3 Documentation

Documentation procedures will be followed as described in Section 5.9.

5.5 VEGETATIVE STRESS SURVEY

The methodology for conducting a vegetative stress survey at OU-2 is discussed in the following paragraphs. The techniques include: aerial photo interpretation, direct vegetation measurements, and selected, process-oriented measurements.

<u>Vegetative Stress Survey Framework</u>

A sequential framework for assessing stress in vegetation is presented below. At virtually every step of the algorithm, decisions will be made either to proceed with the next level of activity or to terminate the assessment process. This will depend on the nature and amount of data obtained from the earlier steps.

- Assemble site maps and aerial photographs.
- Define target zones to be measured.
- Develop vegetation maps.
- Perform ground-truthing.
- Determine the general vegetation characteristics with the Relevé techniques.
- Follow-up with quantitative assessments, if necessary.

Aerial Photograph Interpretation

Existing aerial photographs of OU-2 will be utilized in this survey to verify data obtained from previous investigations and to assess large-scale seasonal and annual vegetational patterns. If enough archival material is not available to fully characterize OU-2, efforts will be made to procure additional aerial photographs and maps.

Direct Observational Methods

Due to the characteristics of the contaminants present, this method may require site personnel to take adequate precautionary and safety measures. The safety and personal protection equipment are described in detail in the Health and Safety Plan.

As the first step in this phase, results of the aerial photo studies will be verified by ground truthing. This will be initiated with analysis of the offsite, uncontaminated border regions associated with the contaminated area.

Ground Truth Maps/Qualitative Assessments - Floristics

The site visit will verify the community transitions and disruptions which are evident from aerial photographs. Depending on the nature and extent of vegetative cover, multiple visits may be done to capture the breadth of species richness within the communities. Botanists familiar with the local flora will be employed to compile the floristics checklist and to spot abnormal breaks in the assemblages of species.

Ground Truth Maps/Qualitative Assessments - Relevé

The **Relevé** method uses structured, subjective reconnaissance with flexible sampling areas to classify similar vegetation types. A "representative" site within a particular vegetation stand is selected and a single Relevé measurement is recorded. Various stands are sampled in order to classify vegetation types.

The details of the sampling procedure will be varied to accommodate the structural and distributional features of vegetational type at OU-2. In general, a stratified random position approach will be used where each distinct vegetation type (bottom land forest, grass, marsh) will be divided into four or more zones of approximately equal area. Sample locations, approximately the same number per zone, will be distributed randomly within each zone. Within each vegetation type, either a minimum sample size of 20 or an estimated number will be used to achieve sample adequacy. The estimated sample number will be calculated using the equation:

$$N = \frac{[S^2t^2]}{d^2}$$

where,

N = sample size

S^2 = sample variance for density or cover

t = student's 't' value for x = 0.05 level and the appropriate degrees of freedom (sample number used to calculate variance)

d = allowable error (10 percent of density or cover proposed)

In order to arrive at a sample plot, the vegetation types may be considered separately. The following definitions, plotting methods and data collection guidelines are widely accepted:

<u>Trees</u>: Erect, woody plants with stem diameter greater than or equal to 10 cm @ 1.4 m above ground level. This is designated as Diameter at Breast Height (DBH).

To quantify trees by the Point Method (or Point-Quarters Method), the species, DBH of the designated trees and distance are recorded. The defined area will be a square plot of size 10 m.

<u>Shrubs</u>: Erect or prostrate woody plants with a DBH less than 10 cm.

Here, a plot of known area, either circular or square in shape ($1m^2$ or 1m x 1m) is established. The number of stems of each species in the plot is recorded.

In addition to collecting the above data for community descriptions, stem and root sections or cores may be collected to provide evidence of differing growth rates in trees.

Data summaries will be prepared for each discernable vegetation unit. For trees, this includes the calculated estimates of density (number of individuals per hectare), basal area (the stem cross-sectional area calculated from the measures of DBH, a surrogate value for dominance), frequency (the percentage of plots having a particular species), and the importance percentage (IP, the mean of the normalized density, basal-area, and frequency values).

The summary values as calculated above may be used to calculate various synthetic indices such as species diversity or coefficient of community. Extreme caution will accompany any interpretation of such values, since natural succession and stress affect the diversity of a community in non-linear patterns. Also, the indices do not provide for inclusion of variance or precision estimates. Furthermore, the effect of the contaminants may be to elevate or decrease diversity.

5.6 MACROINVERTEBRATE STUDY

Aquatic macroinvertebrates will be sampled from the open bottom and along the shoreline of the basin.

5.6.1 Equipment

The samples from the open bottom of the basin will be collected with an Ekman, Ponar or Peterson dredge. Samples from the shoreline will be collected with a fine-meshed dipnet.

5.6.2 Procedure

In each open bottom station, three 0.023-m^2 grab samples will be collected and processed separately. The contents of each grab will be rinsed and concentrated through a No. 30 U. S. Standard Testing Sieve (0.59-mm mesh). Materials retained by the sieve will be transferred to an appropriate-sized, prelabeled container and preserved in 5 percent formalin for transport to the laboratory.

At a given shoreline station, three areas of approximately 0.5 m^2 each will be thoroughly "swept" with the dipnet. The materials netted from each area will be processed separately as described above for the benthic grab samples.

In the laboratory, each macroinvertebrate sample will be prepared by staining with rose bengal for at least 24 hours prior to analysis. After staining, each sample will be gently rinsed through a graded series of sieves to remove fine sediment particles and the formalin, as well as to separate the materials into size fractions. The finest mesh sieve will be 0.59 mm (No. 30). The sample fraction from each screen will be examined under magnification, and the brightly-stained macroinvertebrates will be separated from detrital material, sorted, identified, and counted. All specimens will be identified to the lowest positive and practical taxonomic level. Most specimens of each taxon will be counted; however, appropriate subsampling methods may be used for estimation of totals if exceptionally high densities are encountered.

Results of sample analyses will be used to calculate densities (number per unit area) as well as indices of diversity and equitability for each sampling station.

5.6.3 Documentation

The information pertinent to the macroinvertebrates will be recorded in the field log books as described in Section 5.9. Detailed descriptions of the sediments will also be included for the basin grab samples. These descriptions will be made to be consistent in detail to the sediment descriptions outlined in Section 5.3.3. At the shoreline dipnet sample locations, description of emergent vegetation or other physical features that may affect macroinvertebrate populations will also be recorded.

5.7 FISH SAMPLING

Details of proposed fish sampling in the basin will be provided in the revised SAP based on results of the Phase I studies of bathymetry, surface water, and sediments, as well as a preliminary fisheries reconnaissance to determine availability of species and most effective collecting methods.

In general, the intent is to collect a minimum of 20 individuals each of a predacious species representing the top of the aquatic food chain and a bottom-dwelling, bottom-feeding species. If sufficiently abundant, largemouth bass (Micropterus salmoides) and either yellow or black bullhead (Ictalurus natalis or I. melas) will be sampled to represent the predator and bottom-feeder, respectively. Discrete filets will be removed from each of the 40 fish for analysis. The remaining portions of five of the individuals of each species will also be analyzed to allow for calculation of whole-body concentrations of the target analytes.

During collection of the fish for tissue analyses, numbers and identifies of other species captured or observed will be recorded to provide a general picture of the fish community structure of the basin. It is anticipated that DC electrofishing and hoopnetting will be the primary fish collecting methods, although other gear such as seines and gillnets may be used.

5.8 SAMPLE DESIGNATION

All samples will be identified by a unique numbering system. Additional identification will consist of sample type (soil, water, etc.), location (well number or site coordinates, boring number and depth, etc.), and analysis.

Labels will be used for sample security, identification, and integrity. Information on the sample container will include the following:

- WCC project number;
- Sample station number;
- Date and time of sample collection;
- Designation of the sample as a grab or composite;
- Type of sample (groundwater, surface water, sediment, etc.) and a very brief description of the sampling location;
- The signature(s) of the sampler(s);
- Whether the sample is preserved or unpreserved;
- The general types of analyses to be conducted;
- Any other relevant comments.

All of the containers for each sample set will bear the same number. The anticipated numbering system will consist of a unique identification number established as follows: sample matrix abbreviation/well or other location designation/sequential number for that date. For example, the first discreet sediment sample obtained from a core will be numbered SC-1/01A. For several containers of the same sample, each container will be designated by a letter (A, B, C...) for each container of the sample set. Matrix spikes and matrix spike duplicates will be designated by the letters MS or MSD, respectively, following the date. For example, a matrix spike of the sample above would be designated as MS/SC-1/01A. Blind field duplicates with the same numbering system will be sent to the laboratory.

Once this information has been put on the sample label and the sample label affixed to the jar, the label will be covered with clear vinyl tape to protect this information. The sample identification code will be used to identify each sample in the master field log book and other field documentation logs.

5.9 FIELD DOCUMENTATION

In addition to forms specific to sampling method (boring logs, groundwater collection report, etc.), sampling activities will be documented in a bound field log book with consecutively numbered pages.

- WCC project name and number
- Location and sampling activity and address
- Purpose of sampling
- Number and approximate volume of samples taken
- Description of sampling point
- Date and time of collection
- Collector's sample identification number(s)
- Sample distribution (e. g., chemical laboratory, geotechnical laboratory, etc.)
- Sample preservation
- Field observations
- Any field measurements made, such as pH, specific conductivity or other field parameters
- Weather conditions

The documentation in the log book will be sufficient to reconstruct the sampling situation without relying on the collector's memory.

Groundwater Sampling Report Form

A sample collection log specific to groundwater sampling will be completed for each monitor well sampled at the site. These reports will include static groundwater elevation, volumes purged, weather conditions, etc. A copy of the report is presented on Appendix A.

Field Specific Sampling and Test Reports

Any onsite field testing with a Dissolved Oxygen (DO) meter, pH and conductivity meters will be recorded either in the sampling reports or on separate reports specific to testing procedure.

5.10 DECONTAMINATION PROCEDURES

All sampling equipment will be decontaminated before entering the site and leaving the site. In addition, equipment will be decontaminated between sample locations to prevent cross-contamination. Washwater that is collected during decontamination will be containerized for disposal/treatment by Olin.

All heavy equipment decontamination activities (e.g., boat, vibracore unit, etc.) will occur at the designated heavy equipment decontamination area.

Equipment decontamination is described below:

- The equipment that comes in contact with soil or water (but not in direct contact with samples) will be cleaned with a steam cleaner or hand washed with a brush and alconox detergent to remove oil, grease, and any contamination that has accumulated on the equipment.

The sampling equipment that comes in direct contact with the sample (e.g., bailers, Ekman dredge, shovels, etc.) will be decontaminated using the following procedures:

1. Clean with tap water and laboratory detergent using a brush if necessary to remove particulate matter and surface films.

2. Rinse thoroughly with tap water.

3. Rinse thoroughly with deionized water.

4. Rinse twice with solvent. (isopropanol preferred)

5. Rinse thoroughly with organic-free water and allow to air dry as long as possible.

6. If organic-free water is not available, allow equipment to dry as long as possible. Do not rinse with deionized or distilled water.

7. Wrap with aluminum foil, if appropriate, to prevent contamination if equipment is to be stored or transported.

Solvents will not be used for cleaning of plastic items. Plastics may be used (instead of foil) to wrap equipment after cleaning if all traces of solvents have been removed. All decontamination fluids, except for tap water, must be applied using non-interfering containers and applicators. These should be made of glass, stainless steel or Teflon. Pump sprayers, because of the presence of rubber and greased or oiled leather gaskets and seals, are generally only acceptable for applying tap water.

To verify the adequacy of the decontamination, rinsate samples from the sampling equipment will be obtained as indicated on Table 2. The rinsate samples will be analyzed for the same parameters as the media that was sampled with the equipment.

Personnel will wear appropriate protective clothing during decontamination as required by the Health and Safety Plan. All protective equipment (gloves, boots, etc.) will be decontaminated after use or they will be disposed of in drums, labeled, dated, and stored for ultimate disposal at an approved facility. Disposable safety equipment will be considered to be contaminated after use and will be packaged and disposed of in an approved manner.

6.0
SAMPLE HANDLING AND ANALYSIS

Sample container and preservation requirements are presented in the QAPP (Volume II of this SAP) and summarized in Table 3.

6.1 SAMPLE CONTAINMENT AND SECURITY

Samples will be stored in a manner that will not jeopardize the representativeness of the media sampled. Normally this will mean storage on ice or refrigeration, in closed containers, with minimal head space for soil samples and none for water samples. Samples will be analyzed within the holding times stated in the analytical procedures discussed in the QAPP.

Sample coolers will be under the direct observation of WCC personnel at all times or secured with custody seals to detect tampering. If samples are not attended, they will be kept in a secured facility. All samples will be turned over to the WCC field operations task leader or his designee at the end of the day, along with chain-of-custody forms and field documentation forms. Samples placed in the coolers will be packed with ice or ice packs upon retrieval and will be maintained at 4° C until delivery to the laboratory. Prior to shipment, a second person (other than the one packing the cooler) will verify samples, chain-of-custody and other documentation.

6.2 CHAIN-OF-CUSTODY PROCEDURES

The chain-of-custody procedures document sample possession from the time of collection to final disposition. The procedures herein are consistent with EPA SW 846.

For the purpose of these procedures, a sample is considered in custody if it is:

- In one's actual possession
- In view, after being in physical possession

- Locked so that no one can tamper with it, after having been in physical custody
- In a secured area, restricted to authorized personnel.

A chain-of-custody form will be initiated in the field, and the original will accompany the samples with copies retained at intermediate steps. The following information will be specified for each sample on the chain-of-custody form:

1. Sequential sample number
2. Sample date
3. Sample time
4. Sample location and depth where appropriate
5. Analyses to be performed

The chain-of-custody form will be signed by the sample custodian. It will be placed in a water-tight plastic bag and taped to the underside of the lid of the cooler containing the samples designated on the form. The lid of the cooler will be securely taped shut with custody seals, using evidence tape to allow detection of any possible tampering. Upon arrival in the laboratory, samples will be received by the analytical laboratory representative. Samples contained in the shipment will be compared to the chain-of-custody form to ensure that all samples designated have been received. Sample custody within the laboratory will be maintained on internal tracking forms. A copy of the chain-of-custody form is attached in Appendix A.

Each time responsibility for custody of the sample changes, the new custodian will sign the record and denote the date. An exception would be the commercial carrier, if used. A copy of the signed record will be made and retained by the immediately previous custodian and sent to the designated WCC personnel to allow tracking of sample possession. All changes of custody of samples must be a person-to-person change of physical possession.

Upon completion of the analysis, the custodian responsible for the analysis will complete the chain-of-custody record, file a copy, and send the original with results to the WCC Project Manager for record keeping.

6.3 ANALYSIS

Analysis of the samples collected shall be in accordance with the guidelines provided in the project QAPP (Volume II) of the SAP. All samples shipped for analytical testing shall be accompanied by a Sample Analysis Request Form to document requested analysis. A copy of this form is presented in Appendix A. Analysis will be performed in accordance with the EPA's Contract Laboratory Program Statement of Work (February, 1988 and March 1990) and SW-846, 3rd Edition protocols or EPA approved equivalent. The methodologies will provide analytical data to meet risk assessment requirements.

7.0
REFERENCES

Camp Dresser and McKee Inc. (CDM), Forward Planning Study Report, June 1986.

EPA Engineering Service Branch Standard Operating Procedures (SOPQAM), 1986, updated 1990.

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LaMoreaux, P. E., 1984, Hydrogeology of the Ciba-Geigy Corporation Plant Site, McIntosh, Alabama, unpublished consulting report.

Moore, Donald B., Subsurface Geology of Southwest Alabama, Alabama Geological Survey, Bulletin 99, University of Alabama, 1971.

Olin Corporation, Investigation Report Olin Basin, unpublished technical report, April 21, 1988.

Soil and Material Engineers, Inc. (S&ME), Hydrogeology of the Olin Chemical Group, McIntosh, Alabama Plant, November 1982.

TABLES

TABLE 1

SAMPLING PROGRAM SUMMARY

Sampling (Sample Location)	Purpose	Frequency of Sampling	Estimated No. of Samples	Analytical Parameters
RI/FS Groundwater (Figure 4)	• Determine nature and extent • Verify CERCLA-RCRA equiv. • Assess Miocene contamination	One-time	33	TCL TAL Dissolved Hg Cl^-
	• Groundwater flow direction	Quarterly	113	Water elev.
RCRA Groundwater	• Effectiveness of CAP • Compliance point	Quarterly	37	Hg Cl^- pH VOA
Residential Drinking Water (as identified)	• Assess risk	One-time	TBD	Site specific organics Total Hg TOC TDS TSS Cl^-
Phase 1, Selected Subsample of Sediment grab (Figure 5)	• Identify organic indicators • Assess lateral extent	One-time	21	TCL TAL Soluble Hg pH TOC Sulfide/sulfate
Phase 1, Selected Subsample of Sediment core (Figure 5)	• Identify organic indicators • Assess vertical extent	One-time	~9	TCL TAL Soluble Hg pH TOC Sulfide/sulfate
Phase 1, Subsample of Sediment grab (Figure 5)	• Assess lateral extent	One-time	109	Total Hg
Phase 1, Subsample of Sediment core (Figure 5)	• Assess vertical extent	One-time	~18[1]	Total Hg

TABLE 1 (Continued)

SAMPLING PROGRAM SUMMARY

Sampling (Sample Location)	Purpose	Frequency of Sampling	Estimated No. of Samples	Analytical Parameters
Phase 1, Remaining Subsample of Sediment grab (Figure 5)	• Assess lateral extent	One-time	~100	OI[2]
Phase 1, Remaining Subsample of Sediment core (Figure 5)	• Assess vertical extent	One-time	~12	OI[2]
Phase II Sediment core	• Assess vertical extent • Determine vertical variability in bioaccessible zone	One-time	15	Total Hg OI[2, 4]
Surface water	• Assess lateral and vertical extent • Assess migration	One-time	~14	TCL TAL Dissolved Hg DO pH TOC TSS TDS
Macroinvertebrate (To be determined)	• Assess biological impact	One-time	~15	Identification and Enumeration
Fish (To be determined)	• Assess biological impact • Assess risk	One-time	~50	Total Hg Selected organics[3]

NOTES:

1 Estimate based on 3-foot core from each of three locations, divided into 6-inch vertical intervals.

2 OI = Organic indicator compounds determined from Subsample of core and grab TCL analysis.

3 Organics will be selected based on CLP sediment analyses.

4 The analysis of organic indicator parameter will have detection limits comparable to CLP analyses.

TABLE 2

ANTICIPATED SAMPLE FREQUENCY SUMMARY
OLIN McINTOSH FACILITY
McINTOSH, ALABAMA

Sample Type[1]	Total Estimated Number Samples Tested	Number of Trip Blanks[2]	Number of Field Duplicates[3]	Number of Rinsates	Number of MS/MSD[4]
Groundwater Samples	33	1/Shipment	1/20	1/Event	1/20
Drinking Water Well Samples	TBD	1/Shipment	1/20	1/Event	1/20
Sediment Samples (CLP DQO Level IV)	30	1/Shipment	1/20	1/Event	1/20
Total Mercury Samples	127	1/Shipment	1/20	1/Event	1/20
Sediment Samples (Laboratory Screening Method DQO Level II)	112	1/Shipment	1/20	1/Event	1/20
Surface Water Samples	14	1/Shipment	1/20	1/Event	1/20

NOTES:

1 See QAPP for additional analytical information.
2 Trip blanks analyzed for volatiles only and will be one per sample shipment container.
3 Twenty samples or fraction thereof per sampling event. A sampling event is the period over which the specific sample type is collected.
4 Matrix Spiked/Matrix Spiked Duplicate will be spiked in the laboratory. Matrix Spike and Matrix Spike Duplicates are separate samples.
TBD To Be Determined

2 4 00406

TABLE 3

SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES

Parameter or Category/Matrix	Container	Preservation	Holding[1] Time
Volatiles			
Aqueous	Two 40 ml glass vials with 0.125 inch Teflon-faced silicone septa and open-top polyethylene screw closures cleaned according to Protocol B and maintained according to 300 Series Quality Control and documentation.[2,3]	Cool, 4°C, Zero Headspace[3] or Cool, 4°C, Zero Headspace, HCl to pH < 2[4]	7 days of collection or 14 days of collection
Sediments	Two 4 oz/125 ml glass jars with Teflon-faced polyethylene screw closures cleaned according to Protocol B and maintained according to 300 Series Quality Control and documentation.	Cool, 4°C	14 days of collection
Semivolatiles			
Aqueous	Two 32 oz/1000 ml amber glass wide-mouth bottles with Teflon-faced screw closures cleaned according to Protocol A and maintained according to 300 Series Quality Control and documentation.	Cool, 4°C[5]	7 days of collection 40 days of extraction
Sediments	Two 8 oz/250 ml amber glass wide-mouth bottles with Teflon-faced screw closures cleaned according to Protocol A and maintained according to 300 Series Quality Control and documentation.	Cool, 4°C	14 days of collection 40 days of extraction

TABLE 3 (Continued)

SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES

Parameter or Category/Matrix	Container	Preservation	Holding[1] Time
Pesticide/PCBs			
Aqueous	Two 32 oz/1000 ml amber glass wide-mouth bottles with Teflon-faced screw closures cleaned according to Protocol A and maintained according to 300 Series Quality Control and documentation.	Cool, 4°C, adjust pH to between 5 and 9[5]	7 days of collection 40 days of extraction
Sediments	Two 8 oz/250 ml amber glass wide-mouth bottles with Teflon-faced screw closures cleaned according to Protocol A and maintained according to 300 Series Quality Control and documentation.	Cool, 4°C	14 days of collection 40 days of extraction
Metals			
Metals other than Mercury, Total			
Aqueous	One 32 oz/1000 ml glass wide-mouth bottle with Teflon-faced screw closure or high density polyethylene bottle cleaned according to Protocol A and maintained according to 300 Series Quality Control and documentation.	HNO_3 to pH <2 (metals grade)	180 days of collection
Soils/Sediments and Sludges	One 8 oz/250 ml glass wide-mouth bottle with Teflon-faced screw closure or high density polyethylene bottle cleaned according to Protocol A and maintained according to 300 Series Quality Control and documentation.	Cool 4°C	180 days of collection

TABLE 3 (Continued)

SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES

Parameter or Category/Matrix	Container	Preservation	Holding[1] Time
Metals			
Metals other than Mercury, Dissolved			
Aqueous	One 32 oz/1000 ml glass wide-mouth bottle with Teflon-faced screw closure or high density polyethylene bottle cleaned according to Protocol A and maintained according to 300 Series Quality Control and documentation.	Field filter 0.45 μ HNO_3 to pH < 2 (metals grade)	180 days of collection
Mercury, Total			
Aqueous	Required sample volume included in the Metals Other Than Mercury category unless exclusively requested. One 32 oz/1000 ml glass wide-mouth bottle with Teflon-faced screw closure or high density polyethylene bottle cleaned according to Protocol A and maintained according to 300 Series Quality Control and documentation.	HNO_3 to pH < 2 (metals grade)	28 days of collection

TABLE 3 (Continued)

SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES

Parameter or Category/Matrix	Container	Preservation	Holding[1] Time
Soil/Sediments and Sludges	Required sample volume included in the Metals Other Than Mercury category unless exclusively requested. One 8 oz/250 ml glass wide-mouth bottle with Teflon-faced screw closure or high density polyethylene bottle cleaned according to Protocol A and maintained according to 300 Series Quality Control and documentation.	Cool, 4°C	28 days of collection
Mercury, Dissolved			
Aqueous	Required sample volume included in the Metals Other Than Mercury category unless exclusively requested. One 32 oz/1000 ml glass wide-mouth bottle with Teflon-faced screw closure or high density polyethylene bottle cleaned according to Protocol A and maintained according to 300 Series Quality Control and documentation.	Field filter 0.45μ, HNO_3 to pH < 2 (metals grade)	28 days of collection

TABLE 3 (Continued)

SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES

Parameter or Category/Matrix	Container	Preservation	Holding[1] Time
Mercury, Elutriate			
Aqueous	Two 32 oz/1000 ml glass wide-mouth bottle with Teflon-faced screw closure or high density polyethylene bottle cleaned according to Protocol A and maintained according to 300 Series Quality Control and documentation.	Cool, 4°C	Perform elutriate test 7 days of collection and complete analysis 28 days of collection
Soil/Sediments and Sludges	Two 8 oz/250 ml glass wide-mouth bottle with Teflon-faced screw closure or high density polyethylene bottle cleaned according to Protocol A and maintained according to 300 Series Quality Control and documentation.	Cool, 4°C, Zero headspace	Perform elutriate test 7 days of collection and complete analysis 28 days of collection
Cyanide			
Aqueous	One 32 oz/1000 ml glass wide-mouth bottle with Teflon-faced screw closure or high density polyethylene bottle cleaned according to 300 Series Quality Control and documentation.	Cool, 4°C, NaOH to pH > 12[6]	14 days of collection
Soil/Sediments and Sludges	Required sample volume included in the Metals Other Than Mercury category unless exclusively requested. If requested exclusively, container requirements same as Metals Other Than Mercury category.	Cool, 4°C	14 days of collection

TABLE 3 (Continued)

SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES

Parameter or Category/Matrix	Container	Preservation	Holding[1] Time
Conventionals			
Aqueous			
pH	One 32 oz/1000 ml glass wide-mouth bottle with Teflon-lined screw closure or high density polyethylene bottle cleaned according to Protocol A, B or C and maintained according to 300 Series Quality Control and documentation.	Cool, 4°C	Analyze on receipt in laboratory. Field analysis will also be conducted.
Sulfate			28 days of collection
Chloride			28 days of collection
Total Dissolved Solids			7 days of collection
Total Suspended Solids			28 days of collection
Total Organic Carbon	One 32 oz/1000 ml or smaller glass wide-mouth bottle with Teflon-lined screw closure cleaned according to Protocol A and maintained according to 300 series Quality Control and documentation.	Cool, 4°C H_2SO_4 to pH<2	28 days of collection

3 4 00412

TABLE 3 (Continued)

SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES

Parameter or Category/Matrix	Container	Preservation	Holding[1] Time
Soil/Sedimental Sludges Sulfide	One 8 oz/250 ml amber glass wide-mouth bottle with Teflon-faced screw closure cleaned according to Protocol A and maintained according to 300 Series Quality Control and documentation.	Cool, 4°C, Moisten solid with 2 N Zinc acetate	7 days of collection
Sulfate Total Organic Carbon	One 8 oz/250 ml amber glass wide-mouth bottle with Teflon-faced screw closure cleaned according to Protocol A and maintained according to 300 Series Quality Control and documentation.	Cool, 4°C,	28 days of collection

NOTES:

[1] Holding times may not be applicable for screening method.

[2] Statement of Work for Maintenance of Quality-Controlled Prepared Sample Container Repository, Office of Solid Waste and Emergency Response, U. S. Environmental Protection Agency, Washington, D.C. July, 1987.

Sample container cleaning protocols include:

Protocol	Specifications
A	• Laboratory Grade Detergent Wash and Rinse • Acid, Deionized Water, and Solvent Rinses • Oven Drying, Capping and Packing under quality controlled conditions.
B	• Laboratory Grade Detergent Wash and Rinse

TABLE 3 (Continued)

SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES

- Multiple Deionized Water Rinses
- Oven Drying, Capping and Packing under quality controlled conditions.

C

- Laboratory Grade Detergent Wash and Rinse
- Acid Rinse
- Multiple Deionized Water Rinses
- Air Drying, Capping and Packing under quality controlled conditions.

3 300 Series Quality Control and documentation provides:

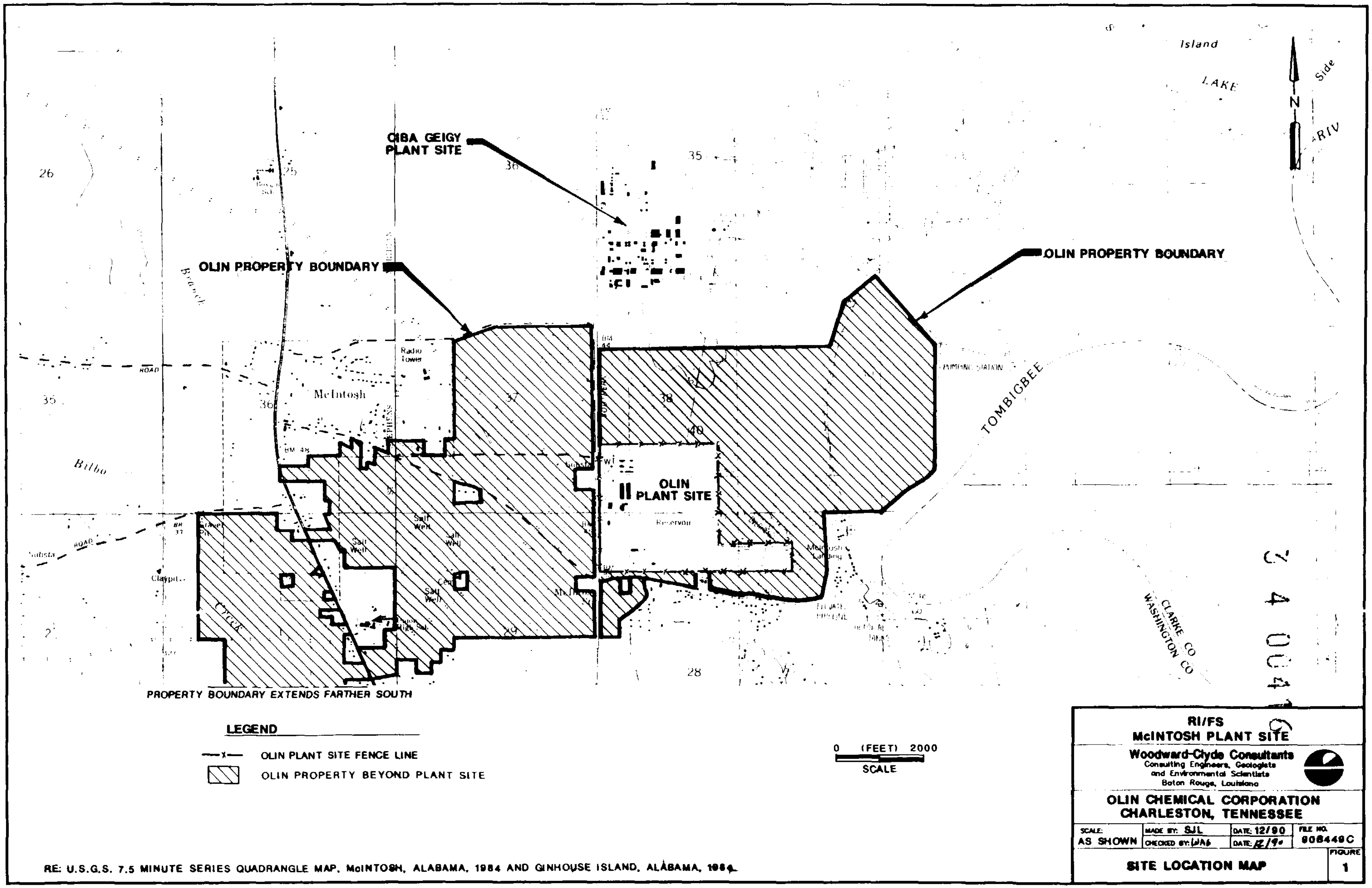
- Certificate of Analysis
- Retention of a virgin container from each lot for one year should additional testing be required
- Lot numbered labels provided for traceability

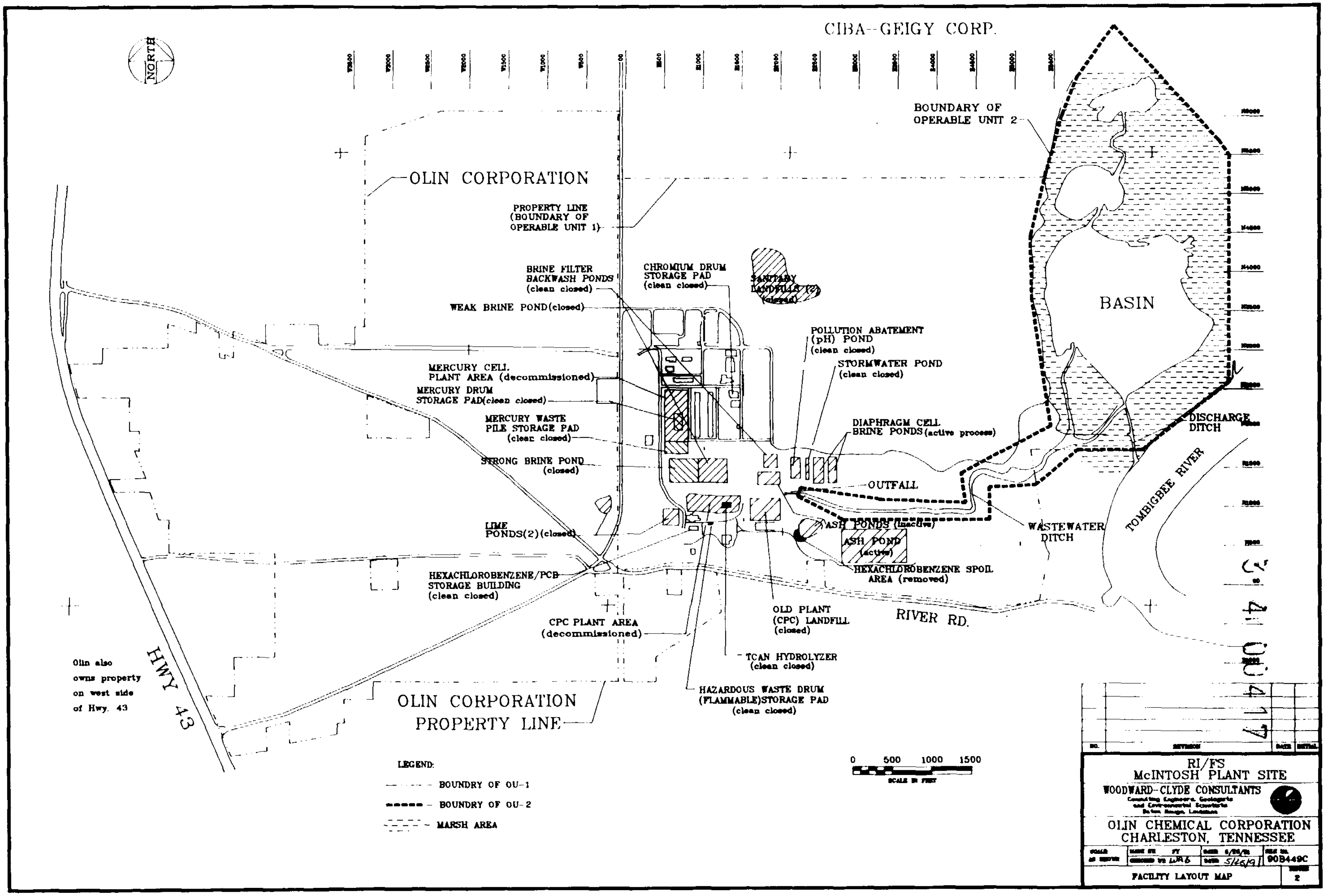
4 Add four drops of ten percent solution of $Na_2S_2O_3$ per 40 ml vial if residual chlorine present.

5 Add 0.75 ml ten percent solution of $Na_2S_2O_3$ per liter if residual chlorine present.

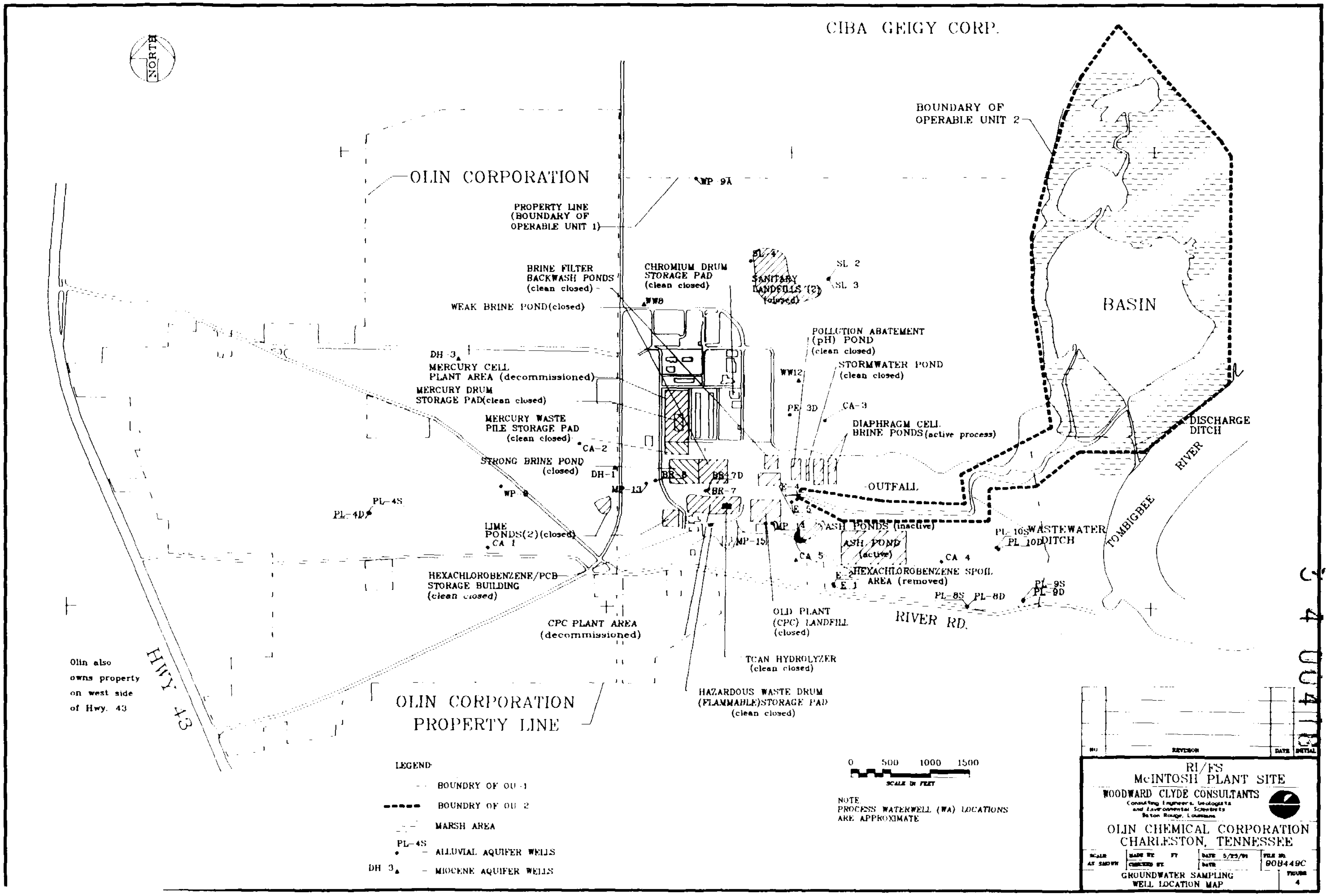
6 Add 0.6 g ascorbic acid per liter if residual chlorine present.

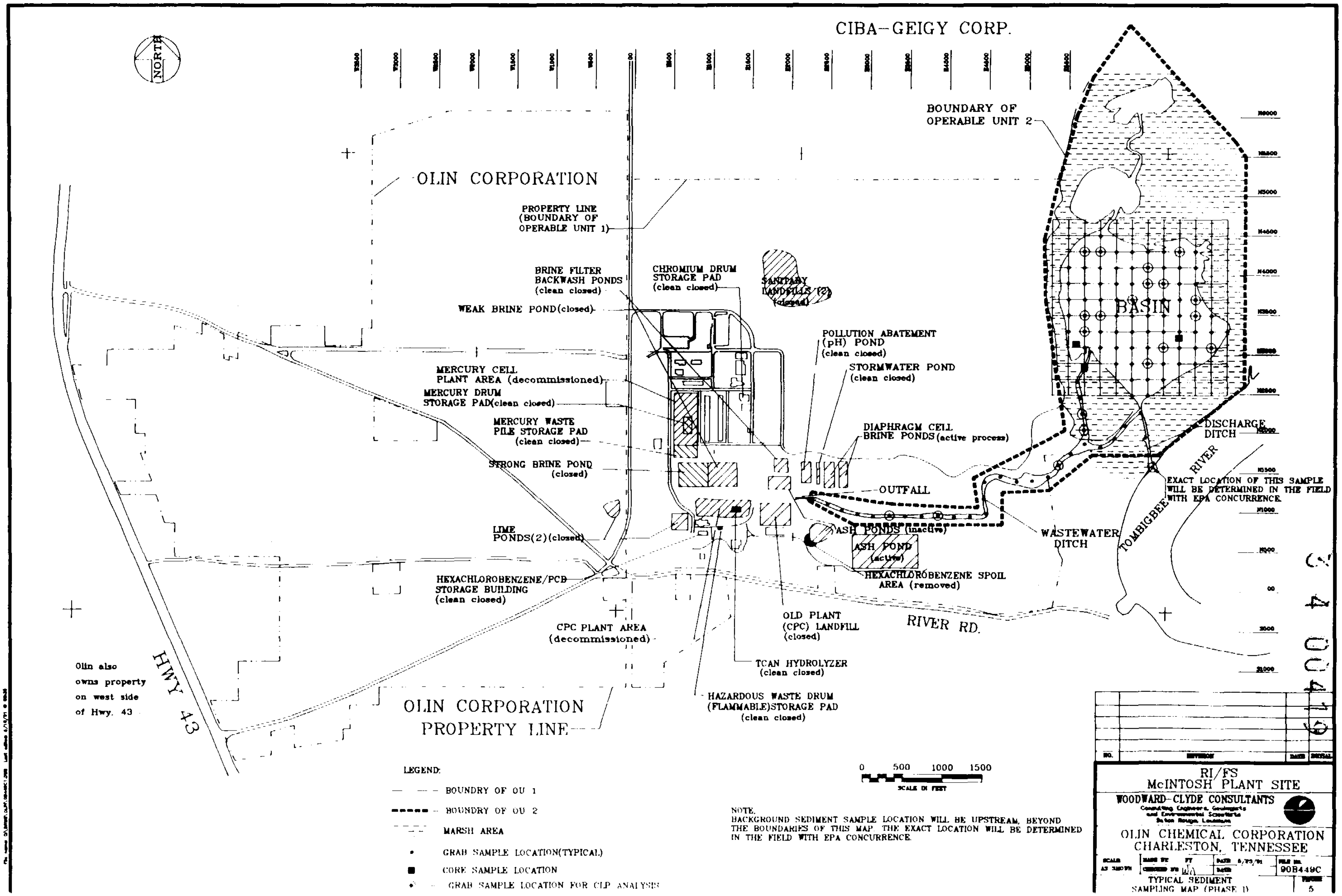
FIGURES


CIBA GEIGY PLANT SITE
OLIN PROPERTY BOUNDARY
OLIN PROPERTY BOUNDARY
OLIN PLANT SITE
McIntosh
Radio Tower
Reservoir
Salt Well
Island
LAKE
RIV
TOMBIGBEE
CLARKE CO
WASHINGTON CO
Bilbo
Creek
Branch
ROAD
PUMPING STATION
PROPERTY BOUNDARY EXTENDS FARTHER SOUTH
LEGEND
OLIN PLANT SITE FENCE LINE
OLIN PROPERTY BEYOND PLANT SITE
0 (FEET) 2000
SCALE
N
RI/FS
McINTOSH PLANT SITE
Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists
Baton Rouge, Louisiana
OLIN CHEMICAL CORPORATION
CHARLESTON, TENNESSEE
SCALE: AS SHOWN
MADE BY: SJL
DATE: 12/90
CHECKED BY:
FILE NO. 906449C
SITE LOCATION MAP
FIGURE 1
RE: U.S.G.S. 7.5 MINUTE SERIES QUADRANGLE MAP, McINTOSH, ALABAMA, 1984 AND GINHOUSE ISLAND, ALABAMA, 1984.



CIBA-GEIGY CORP.
NORTH
OLIN CORPORATION
PROPERTY LINE (BOUNDARY OF OPERABLE UNIT 1)
BOUNDARY OF OPERABLE UNIT 2
BASIN
BRINE FILTER BACKWASH PONDS (clean closed)
CHROMIUM DRUM STORAGE PAD (clean closed)
WEAK BRINE POND(closed)
POLLUTION ABATEMENT (pH) POND (clean closed)
STORMWATER POND (clean closed)
MERCURY CELL PLANT AREA (decommissioned)
MERCURY DRUM STORAGE PAD(clean closed)
MERCURY WASTE PILE STORAGE PAD (clean closed)
DIAPHRAGM CELL BRINE PONDS(active process)
DISCHARGE DITCH
STRONG BRINE POND (closed)
OUTFALL
TOMBIGBEE RIVER
LIME PONDS(2)(closed)
ASH PONDS (inactive)
ASH POND (active)
WASTEWATER DITCH
HEXACHLOROBENZENE SPOIL AREA (removed)
HEXACHLOROBENZENE/PCB STORAGE BUILDING (clean closed)
OLD PLANT (CPC) LANDFILL (closed)
RIVER RD.
CPC PLANT AREA (decommissioned)
TCAN HYDROLYZER (clean closed)
HAZARDOUS WASTE DRUM (FLAMMABLE)STORAGE PAD (clean closed)
Olin also owns property on west side of Hwy. 43
HWY 43
OLIN CORPORATION PROPERTY LINE
LEGEND:
BOUNDRY OF OU-1
BOUNDRY OF OU-2
MARSH AREA
0 500 1000 1500
SCALE IN FEET
RI/FS
McINTOSH PLANT SITE
WOODWARD-CLYDE CONSULTANTS
OLIN CHEMICAL CORPORATION
CHARLESTON, TENNESSEE
90B449C
FACILITY LAYOUT MAP
2


NORTH
CIBA GEIGY CORP.
OLIN CORPORATION
BOUNDARY OF OPERABLE UNIT 2
WP 9A
PROPERTY LINE (BOUNDARY OF OPERABLE UNIT 1)
BRINE FILTER BACKWASH PONDS (clean closed)
CHROMIUM DRUM STORAGE PAD (clean closed)
SL-4
SANITARY LANDFILLS (2) (closed)
SL 2
SL 3
WEAK BRINE POND(closed)
WW8
BASIN
POLLUTION ABATEMENT (pH) POND (clean closed)
STORMWATER POND (clean closed)
WW12
DH-3
MERCURY CELL PLANT AREA (decommissioned)
MERCURY DRUM STORAGE PAD(clean closed)
PE 3D
CA-3
MERCURY WASTE PILE STORAGE PAD (clean closed)
CA-2
DIAPHRAGM CELL BRINE PONDS(active process)
DISCHARGE DITCH
STRONG BRINE POND (closed)
DH-1
BR-8
BR-7D
BR-7
OUTFALL
RIVER
MP-13
WP 8
PL-4S
PL-4D
LIME PONDS(2)(closed)
CA 1
MP 14
MP-15
ASH PONDS (inactive)
ASH POND (active)
WASTEWATER DITCH
PL-10S
PL-10D
TOMBIGBEE
CA 5
CA 4
HEXACHLOROBENZENE/PCB STORAGE BUILDING (clean closed)
HEXACHLOROBENZENE SPOIL AREA (removed)
E 1
PL-9S
PL-9D
PL-8S
PL-8D
CPC PLANT AREA (decommissioned)
OLD PLANT (CPC) LANDFILL (closed)
RIVER RD.
TCAN HYDROLYZER (clean closed)
Olin also owns property on west side of Hwy. 43
HWY 43
OLIN CORPORATION PROPERTY LINE
HAZARDOUS WASTE DRUM (FLAMMABLE)STORAGE PAD (clean closed)
LEGEND
BOUNDRY OF OU-1
BOUNDRY OF OU 2
MARSH AREA
PL-4S ALLUVIAL AQUIFER WELLS
DH 3 MIOCENE AQUIFER WELLS
0 500 1000 1500
SCALE IN FEET
NOTE
PROCESS WATERWELL (WA) LOCATIONS ARE APPROXIMATE
NO. REVISION DATE INITIAL
RI/FS
McINTOSH PLANT SITE
WOODWARD CLYDE CONSULTANTS
OLIN CHEMICAL CORPORATION
CHARLESTON, TENNESSEE
SCALE AS SHOWN
FILE NO. 90B449C
GROUNDWATER SAMPLING WELL LOCATION MAP
FIGURE 4


NORTH
CIBA-GEIGY CORP.
OLIN CORPORATION
PROPERTY LINE (BOUNDARY OF OPERABLE UNIT 1)
BOUNDARY OF OPERABLE UNIT 2
BRINE FILTER BACKWASH PONDS (clean closed)
CHROMIUM DRUM STORAGE PAD (clean closed)
SANITARY LANDFILLS (2) (closed)
WEAK BRINE POND(closed)
BASIN
POLLUTION ABATEMENT (pH) POND (clean closed)
STORMWATER POND (clean closed)
MERCURY CELL PLANT AREA (decommissioned)
MERCURY DRUM STORAGE PAD(clean closed)
MERCURY WASTE PILE STORAGE PAD (clean closed)
DIAPHRAGM CELL BRINE PONDS (active process)
DISCHARGE DITCH
STRONG BRINE POND (closed)
OUTFALL
EXACT LOCATION OF THIS SAMPLE WILL BE DETERMINED IN THE FIELD WITH EPA CONCURRENCE.
TOMBIGBEE RIVER
LIME PONDS(2)(closed)
ASH PONDS (inactive)
ASH POND (active)
WASTEWATER DITCH
HEXACHLOROBENZENE/PCB STORAGE BUILDING (clean closed)
HEXACHLOROBENZENE SPOIL AREA (removed)
CPC PLANT AREA (decommissioned)
OLD PLANT (CPC) LANDFILL (closed)
RIVER RD.
TCAN HYDROLYZER (clean closed)
Olin also owns property on west side of Hwy. 43
HWY 43
OLIN CORPORATION PROPERTY LINE
HAZARDOUS WASTE DRUM (FLAMMABLE)STORAGE PAD (clean closed)
LEGEND:
BOUNDRY OF OU 1
BOUNDRY OF OU 2
MARSH AREA
GRAB SAMPLE LOCATION(TYPICAL)
CORE SAMPLE LOCATION
GRAB SAMPLE LOCATION FOR CLP ANALYSIS
0 500 1000 1500
SCALE IN FEET
NOTE:
BACKGROUND SEDIMENT SAMPLE LOCATION WILL BE UPSTREAM, BEYOND THE BOUNDARIES OF THIS MAP. THE EXACT LOCATION WILL BE DETERMINED IN THE FIELD WITH EPA CONCURRENCE.
RI/FS
McINTOSH PLANT SITE
WOODWARD-CLYDE CONSULTANTS
OLIN CHEMICAL CORPORATION
CHARLESTON, TENNESSEE
AS SHOWN
90B449C
TYPICAL SEDIMENT SAMPLING MAP (PHASE I)
5
2 4 0 0 4 6

APPENDIX A

FIELD FORMS

Woodward-Clyde Consultants

3 4 00421

GROUND WATER COLLECTION REPORT

PROJECT NUMBER AND NAME ______________________ LOCATION __________
COLLECTOR/OPERATOR ______________________ WELL NO. __________
TYPE OF SAMPLE ________ ( ) GRAB ( ) COMPOSITE ( ) OTHER __________
METHOD OF SAMPLING IF OTHER THAN MONITOR WELL __________ SHUTTLE NO. __________

MONITOR WELL INFORMATION

EVACUATION: DATE/TIME __________ METHOD OF EVACUATION __________
INITIAL DEPTH TO WATER LEVEL __________ TOP OF CASING TO BOTTOM __________
GALLONS PER WELL VOLUME __________ TOTAL GALLONS EVACUATED __________
FINAL DEPTH TO WATER __________ ELEVATION TOP OF CASING __________

SAMPLING: DATE/TIME __________ METHOD OF SAMPLING __________
DEPTH TO WATER LEVEL __________

SAMPLE DATA

FIELD REPLICATE #1	TEMP. ______	pH ______	CONDUCTIVITY ______
FIELD REPLICATE #2	TEMP. ______	pH ______	CONDUCTIVITY ______
FIELD REPLICATE #3	TEMP. ______	pH ______	CONDUCTIVITY ______
FIELD REPLICATE #4	TEMP. ______	pH ______	CONDUCTIVITY ______

GENERAL INFORMATION

WEATHER CONDITIONS AT TIME OF SAMPLING __________
SAMPLING CHARACTERISTICS __________
CONTAINERS AND PRESERVATIVES __________

RECOMMENDATIONS/OBSERVATIONS __________

SAMPLE ID NUMBERS __________
SAMPLING PERSONNEL TIME ______ TO ______

DATE __________

____
(SIGNED)

LOCK OR SEAL NUMBER __________ REPLACEMENT SEAL NUMBER __________

34 00422

Woodward-Clyde Consultants

SAMPLE ANALYSIS REQUEST FORM

PROJECT NAME ______________________ LOCATION ______________________
PROJECT NUMBER ______________________ SAMPLING TEAM ______________________
PROJECT CONTACT ______________________ PURCHASE ORDER NO. ______________________
REPORTING ADDRESS ______________________ PROJECT CONTACT PHONE NO. ______________________
______________________ REQUESTED TURNAROUND ______________________
______________________ LABORATORY DESTINATION ______________________

SAMPLE NO.	SAMPLE TYPE	SAMPLE VOLUME	PRESERVATIVE	REQUESTED ANALYSIS	COMMENTS

SPECIAL HANDLING (e.g. ICE, DRYROOM, FLAMMABLE, ETC.) ______________________

DATE SHIPPED: ______________________ PACKAGED BY: ______________________
SHIPPING METHOD: ______________________ AIRBILL/INVOICE: ______________________
CHAIN – – CUSTODY ATTACHED? YES ____ NO ____

CHAIN-OF-CUSTODY RECORD

PROJECT No.	PROJECT NAME	NUMBER CONTAINERS													REMARKS
SAMPLERS: (Printed Name & Signature)															
SITE															
ADDRESS															

STATION	STATION LOCATION	DATE/TIME	COMP or GRAB													REMARKS

Relinquished by: (Printed Name & Signature)	DATE/TIME	Received by: (Printed Name & Signature)	Relinquished by: (Printed Name & Signature)	DATE/TIME	Received by: (Printed Name & Signature)
REMARKS			REMARKS		

Relinquished by: (Printed Name & Signature)	DATE/TIME	Received by: (Printed Name & Signature)	Relinquished by: (Printed Name & Signature)	DATE/TIME	Received by: (Printed Name & Signature)
REMARKS			REMARKS		